EDP industry report

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

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EDP INDUSTRY REPORT,
VOLUME 19, APRIL 1983-84

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"The Gray Sheet"

DAVID MOSCHELLA, EDITOR April 13, 1984 ● V/19, NO.24 P.J. MCGOVERN, PUBLISHER

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MINI VENDORS RUSH TO BUILD HIGH END SYSTEMS; CROWDED FIELD LEADS TO TOUGH COMPETITION

The last twelve months have not been good ones for vendor credibility. At the high end, DEC cancelled its 10 and 20 follow-on effort, while Sperry, Trilogy and Honeywell have suffered major shipment delays. At the supermini level, DEC's Venus machines remain distant, and HP has scrubbed its 32-bit Vision project in favor of its Spectrum series not due till 1986. STC bagged its 4300-size system altogether. Meanwhile, IBM is stamping out its complex 308X CPUs as easily as Nabisco makes cookies. Is the non-IBM world losing its touch?

Part of the problem is that the non-IBM vendors have had to face an era of limits. Over the last two years, these companies have watched their profit margins shrink and their product lines expand. Today, only IBM can be an across-the-board supplier. The rest face difficult resource allocation decisions -- PCs, office automation, high-end scientific machines, in-house vs. merchant microprocessors, etc. A wave of specialized start-ups using the latest in technology has only aggravated the problem. In this issue, EDP/IR takes a look at how the mini makers are coping with these pressures. Some key points:

- Technology. The transition to ECL logic chips is proving difficult, especially for high-density ECL. Among major U.S. mini vendors, only Prime (with its 10K 9950) has been delivering an ECL machine in quantity. Harris is beginning deliveries of a 100K ECL system.

- Packaging. IBM's proven TCM technology will allow it to easily make faster mid-range systems for the rest of the decade. The non-IBM vendors (except Honeywell) have yet to take this expensive step. DEC and others hope Trilogy can take it for them.

- R&D. With profit margins tight, the ratio of R&D to net earnings has steadily risen over the last few years. At the same time, supermini development costs are increasing rapidly. Even DEC now admits openly that it must continue to narrow its product line because of R&D constraints.

- New products. DEC, AT&T, Wang, and Gould have new high-end minis.

- Volume. DEC says it has shipped 25,000 Vax systems.

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COMPARISON HIGH-END CPUs, MAJOR MINI VENDORS

	Model	Memory	Price	MIPS	Logic	Cycle Time	Available
DEC	785	4MB	$205,000	1.6	TTL	133 nsec	4Q/1984
AT&T	3B20S	4	330,000*	1.8	AMD 2901	NA	2Q/1984
Wang	VS/300	4	170,000	3.5	NA	120	1Q/1985
Prime	9950	4	361,000*	2.5	ECL	80	3Q/1983
DG	10000	4	170,000	2.5	TTL	140	2Q/1983
IBM	4381	4	500,000	2.5	TTL	68	1Q/1984
Harris	1000	4	300,000	4.5	ECL	75	2Q/1984
Gould	9705	4	245,000	4.5	ECL		3Q/1984
Elxsi	6400	8	385,000*	4.0	ECL	50	3Q/1983

Notes: Prime and AT&T do not break out CPU prices separately; their prices include 300MB disk, a tape drive, printer, and console. Elxsi price includes: two 474MB drives, tape, line printer, and 32 RS-232 ports.

REVENUES, EARNINGS, AND R&D SPENDING, MAJOR MINI VENDORS, ($M) 1978-1983

	Rev. 1983	Rev. 1978	Avg. Grth.	R&D 1983	R&D 1978	Earn. 1983	Earn. 1978	1983 R&D/Earn.	1978 R&D/Earn.
DEC	4,271	1,436	24	472	115	283	142	1.7	0.8
HP	2,420	761	26	254	67	235	64	1.1	1.0
Wang	1,538	198	51	117	16	152	9	0.8	1.9
DG	829	379	17	84	38	23	40	3.6	0.9
Prime	516	93	41	43	8	32	8	1.3	0.9
Tandem	418	55	50*	39	5	30	5	1.3	0.9
Harris	318	186	11	20	12	8	10	2.4	1.3
P. Elm.	214	131	10	17	9	9	6	2.0	1.6
Total	10,524	3,239	27	1,046	270	772	284	1.4	0.9

Notes: Tandem figures are for the four years 1979-1983. HP, Harris, and Perkin Elmer net earnings have been calculated by applying effective corporate tax rate to pre-tax computer division earnings. R&D spending for these three has been estimated by applying corporate R&D rate to computer business revenues. Prime 1983 R&D spending is based on 1982 ratios.

DEC announces 785; Olsen talks

Although DEC's 785 will appeal to those 780 users in need of more horsepower, this was not one of the more exciting CPU announcements ever made. By using some faster TTL chips, a larger (32K) cache, a writable control store, and a new floating point accelerator, performance is said to improve 50%-70%. The machine cycle time has been cut one third (from 200 to 133 nanoseconds). The 785 costs about 35% more ($195,000, compared to $140,000 for the /780.)

A 50% jump in power for 35% more money allows DEC to introduce the 785 without cutting 780 prices, and maintains DEC's premium pricing policy. Loyal DEC customers must decide whether to buy (or field upgrade to) a 785 or wait for the improved price/performance of Venus, and hope that DEC can deliver. DEC President Ken Olsen noted that, among its customers, manufacturing, CAD/CAM, and office automation users were most in need of additional processing power.

At a meeting of security analysts in February, Olsen said that Venus would be shipped this year, but at the 785 announcement all he would say was "I'd be broken-hearted if it didn't," noting that in complex projects like this, it is easy to slip a few months. Rumors of Venus system instability continue.

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The 785 won't be available until September with full volume shipments in early 1985. Thus, users who order a 785 may well see Venus introduced before they receive their machine. Since Venus will probably be at least twice as fast as the 785, performance overlap shouldn't be a problem. But the expectation is that Venus will establish significantly more attractive price/performance levels, probably forcing 785 price cuts once deliveries begin.

As for the /780, DEC says it has been having one of its best years ever. 780 users can field upgrade to the 785. The quoted $90,000 price tag is not very attractive, but discounts are believed to run up to 50%. Olsen says he expects "a fairly large percent" to take advantage of the field upgrade option. He also noted that DEC's Vax Cluster concept has been received better than expected with "several hundred" installations. OEMs, schools, banks, and computer firms (e.g., those with lots of terminals) are among the most eager users.

Olsen talks shop

At the 785 press conference, Olsen was available for extensive Q&A. Experience cautions against putting too much faith in anything said at these sessions, but for the record, here's the gist of what was said.

- Trilogy. DEC has lots of people working with Trilogy, and says its still the best technology around. DEC hopes to simplify the technology so that it can be used across a wide range of systems.

- AT&T. The old AT&T accounted for about 7% of DEC's business. EDP/IR estimates the new AT&T accounts for only 2-3%. Olsen expects sales to both AT&T and RHCs to stay strong. DEC is used to competing with its customers. It has beaten AT&T in several bids because "VMS is better than Unix." Unix has potential but isn't all there yet.

- New architectures. DEC may explore parallel or RISC architectures for specific applications where VMS is not well suited.

- Fault tolerant systems. DEC has built several fault tolerant machines in the past, but hasn't marketed them because of a lack of customer interest. He characterized fault-tolerant systems as "passe," saying that Vax cluster meets almost all of this need.

- PCs. Shipments are close to plans, but financials are down. PCs are a niche and a "complement to our normal business."

Software notes

DEC's new relational data base products (Rdb/VMS - $9,000 and Rdb/ELN - $7,500) run across the entire Vax line. (Vax/ELN is a high performance, real time operating system for Vax systems up through the /750.) DEC expects its Codasyl DBMS to remain strong in highly structured, performance-oriented tasks.

DEC still hasn't straightened out its software pricing on the Microvax. All it will say is that VMS will be modularized for specific tasks, and that prices will be announced in the next several months. Additionally, DEC said that its All-in-one software would be announced for the Microvax within 6-9 months. At this time, the Microvax does not support the high speed Vax cluster bus; it can attach through an Ethernet link.

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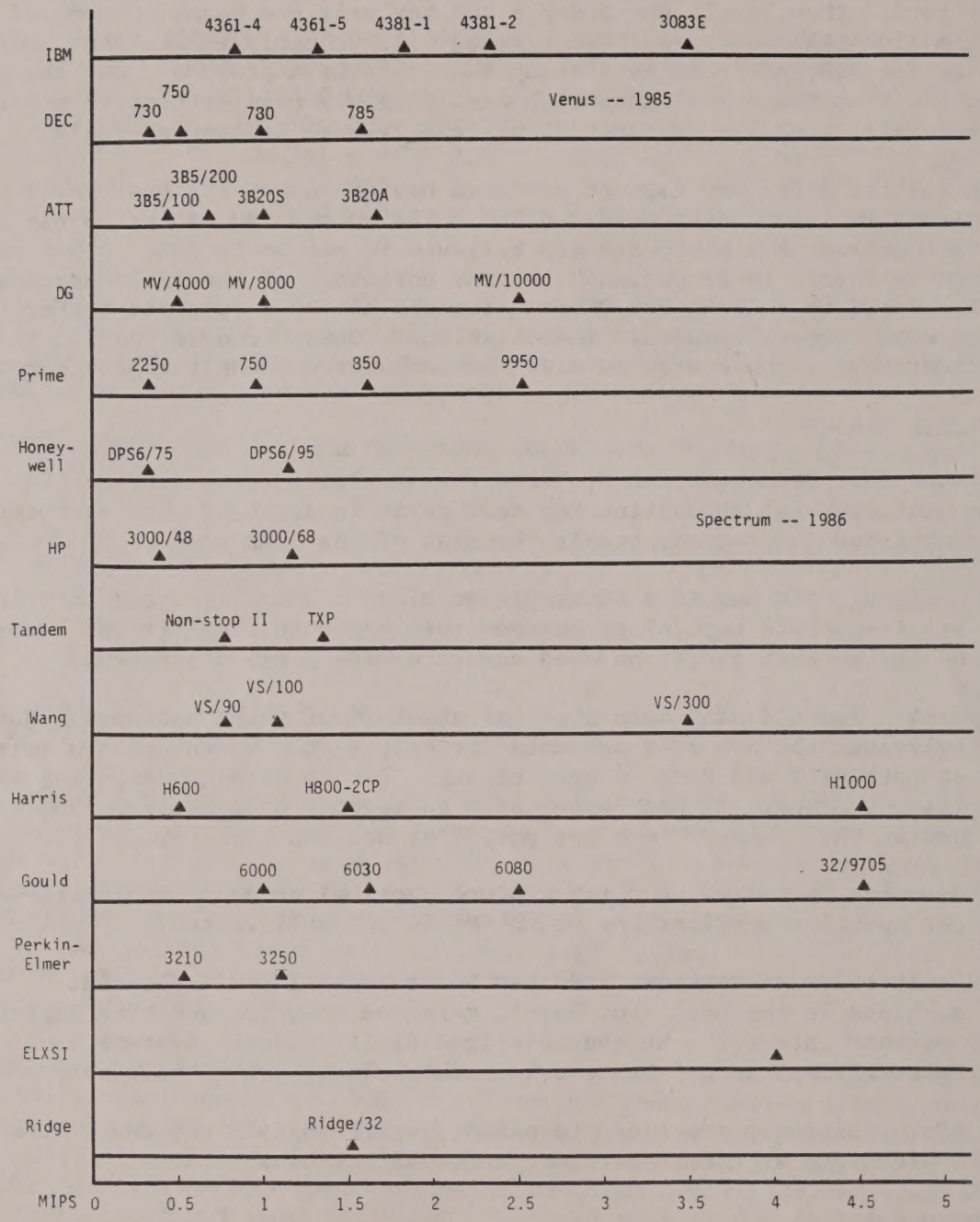
MIP RATINGS, CURRENT SUPERMINI PRODUCTS



The MIPS figures used have been vendor supplied, except in the case of IBM. They primarily refer to millions of Whetstone (Fortran) instructions, but not always. Internal instruction rates do not always translate into overall system performance. The efficiency of the operating system and I/O facilities are also major factors. Additionally, not all instructions are equal.

Raw price/performance is only one aspect of the user's decision-making process. Peripheral support and capacity, the total cost of ownership, development tools, third party products, software pricing, languages supported, data base products, expandability, communications, service, support, and training are all important ingredients. As is the case in the mainframe world, conversion from one vendor to another is often a difficult process.

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Supermini vendor round-up

Wang. Although a high end VS machine had been expected for some time, many observers were surprised (some even skeptical) about the power of the new VS/300. Billed as three times as fast as the VS/100, Wang had no qualms about calling this a 3.5 MIPS machine. Although the circuitry is believed to be ECL, for some reason Wang refuses to officially confirm or deny this. The machine has a relatively modest 120 nanosecond processor time, but uses three-stage pipelining to boost performance. If Wang can actually deliver the machine in January 1985, it will have an aggressive high end entry. Wang cites office automation and transaction processing as key markets.

Hewlett-Packard. The high end of HP's 3000 customer base had to be disappointed to hear that the company's planned 32-bit Vision system got scrapped in favor of the so-called Spectrum line, "estimated" for 1986. HP says that the high end of this series will be "many, many times the 3000/68," rated at about 1 MIPS. Spectrum will use NMOS technology and is expected to be a single scalable architecture that will finally unite HP's 1000 and 3000 series. Unix will probably be the key. Talk of Risc is just gossip at this point.

In the short term, HP will this year introduce its "mighty mouse" system, a low cost member of the 3000 series that is "office worthy." It also says that it will put its Horizon relational data base on both its proprietary MPE operating systems and on Unix in the "1985 timeframe," adding that Horizon will be "compatible with IBM's relational data base interface," whatever that means.

Data General. In a total reversal of the situation 18 months ago, DG is trying to tone down the rampant bullishness that surrounds it. For the first six months of its fiscal 1984, revenues are up a solid 27%, and earnings in the latest quarter were more than double those of a year ago. The company is taking its office automation efforts seriously and has announced four third-party decision support products -- from Logica, Computer Modeling, Scientific Information Retrieval, and Rational Data Systems. DG reports 18,000 CEO users worldwide. For the scientific market, it has agreed to sell International Imaging Systems' array processors.

Elxsi. Although hardly a major vendor, the San Jose start-up has attracted considerable attention as sophisticated users such as NASA and the Australian Aeronautics Research Lab place major orders. Elxsi expects to ship some 44 CPUs this year, virtually all into computer-intensive scientific environments, especially as a high performance front-end to a Cray or CDC supercomputer. In July of this year it expects to announce Unix System V support, but with some Berkeley features. A company spokesman said interest from commercial users has picked up since Elxsi published its U.S. Steel Cobol benchmarks which showed it to be faster than a 3081K, and just under the Amdahl 5860.

Gould. The company recently unveiled two lines of superminis. The high-end 32/97 uses ECL chips and four-stage pipelining, along with a 32K cache to crank out 4.6 MIPS. It can also be had in a tightly-coupled system that claims 8.4 MIPS. The So-called Concept line supports both Gould's MPX-32, and its UTX-32 (System V plus Berkeley 4.2). Gould also introduced its Powernode 6000 series which goes from 1-3 MIPS.

Prime shipped 100 9950s in 1983 (volume shipments began in September) and reports that order rates are up "significantly" this year.

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Mini vendors trapped in PBX war

Now that it is clear that the PBX will play a major role in handling data terminal traffic, the interface between the PBX and the computer has become a major issue. As the first effort to standardize these connections, the Computer-to-PBX Interface (CPI) gained the support of the major PBX vendors (except AT&T) and also the major mini makers. Northern Telecom and DEC proposed CPI as a standard to the Electronic Industry Association.

But in March, AT&T unveiled its Digital Multiple Interface (DMI), and quickly won support of key mini makers such as Wang, DG, HP, and Honeywell. Thus far, the non-AT&T PBX makers have been mute, saying they are in an evaluation period. DMI is currently only supported on AT&T's System 85, of which only a few hundred have been installed. IBM has yet to comment in any way.

The differences between the two standards are significant. CPI with its in-band signalling supports 56 Kbit channels, and DMI (with its common channel signalling) supports 64 Kbits. AT&T's approach is more in tune with CCITT international standards efforts, as common channel signalling will be proposed as a standard for ISDN systems. The ISDN specifications seem to be progressing faster than history would suggest and may even be completed within two years.

Obviously, from an R&D, software, manufacturing, and user point of view, one standard is better than two. But at this time, whether CPI will yield to DMI, or whether the two will fight it out in the market is by no means clear.

More deals with satellite vendors

Recently, both HP and Prime have announced satellite transmission deals with Vitalink. Wang and Tandem announced satellite agreements some time ago, and rumor has it that DEC and Vitalink are currently in serious negotiations.

What's going on? The history of data transmission via satellite has been rocky at best, with the difficulties of Satellite Business Systems being the main example. (Comsat may try to sell its stake in the venture, most likely to IBM). The volume of data traffic just hasn't been high enough to justify dedicated earth stations, and teleconferencing has yet to catch on. No one has made any real money carrying data via satellite, and the economics may get even worse once NASA stops subsidizing satellite launches.

EDP/IR doesn't think these deals amount to much. The computer vendors are investing very little time or money in the process. Vitalink will work out protocol links, provide the earth stations and carry the traffic. Prime and HP get another option to offer their customers and answer charges that they don't have a "wide area solution." Neither Prime nor HP has announced any customers for the systems, although HP plans to use the service in-house.

The main attraction of Vitalink seems to be that its systems are easy to use and transparent to the user. HP notes that the satellite earth station ($140,000) hooks directly to the 3000's I/O, and looks just like a phone link. HP sees the service being used in file transfer tasks such as inventory control, financial management, and CAD/CAM. Prime mentions: CAD/CAM, electronic mail, computational timesharing, videoconferencing, and transaction processing. The economics of satellite use may improve some once ku-band satellites are in wide use since they allow for smaller, less expensive earth stations.

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IBM BRINGS PC INTO THE MAINSTREAM
BUILDS LINKS TO DISPLAYWRITER, 5520, 8100, ETC.

As IBM kicks off what will surely be a parade of IBM software options for the PC, it is important to keep in mind that the PC is still an open architecture product. The folks in Boca Raton will continue to publish PC specs, but if another IBM group wants to take the PC and add proprietary hardware or software, it is free to do so, just like third parties do today. These groups within IBM have no more need to be "open" than does a Lotus or Visicorp.

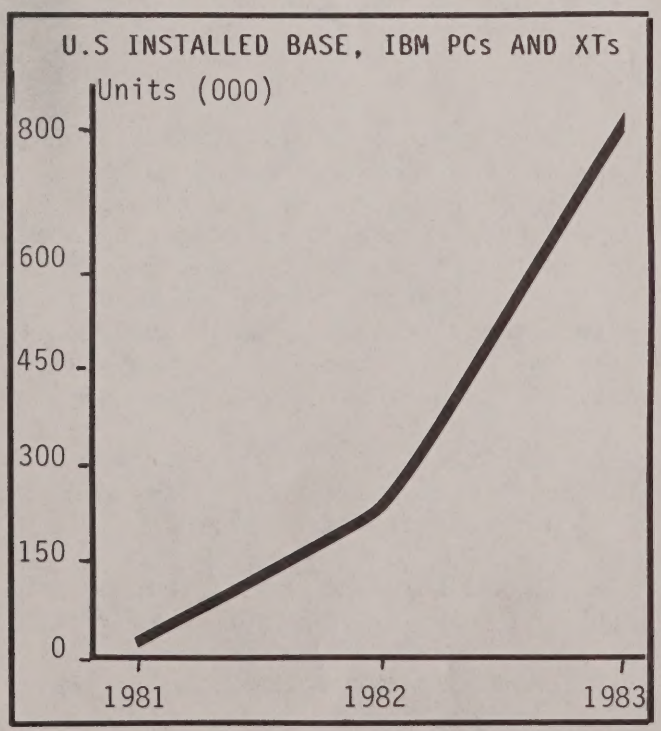
That said, the recent text processing options for the PC are clear evidence that what IBM giveth, it can easily take away. High function PC word processing and the ability to transmit revisable text between the PC and other IBM small systems will give IBM a major advantage in corporate accounts concerned with compatibility. Were IBM to introduce similar exchange capabilities for spreadsheets and graphics, the effect would be dramatic. Some key points:

- LANs. Now that the PC can be connected to the mid-range systems, IBM has much more incentive to bring out local area network products.
- Peer-to-peer. The PC can exchange revisable form documents with the Displaywriter, the 5520, or another PC without needing Disoss.
- DCA/DIA. The PC supports DCA and will support the Document Interchange architecture. IBM has also pledged S/1 support of DCA/DIA.
- 8100 rebirth. The 8100 (with new models, software, and big disks) is being positioned to play a major role as a PC controller.
- Prices. The WP software becomes available this quarter. Prices are competitive -- the Displaywrite 2 software (equivalent to Textpack 4) costs $299, and 5520-type software (called PCWriter) costs $199. A stripped down Displaywrite 1 package (mostly for the Jr.) costs $95.

With more than 800,000 PC and PC XTs in the U.S. alone, the market for add-ons and enhancements has gotten large enough that lots of different IBM groups are sensing opportunities. It's almost as if the third-party vendors are providing IBM with hands-on market research.

PC users can now use the Displaywriter's $3,500 letter quality printer, and IBM is building the type of adapters and connectors previously only available from non-IBM sources.

With these announcements, IBM has essentially begun the process of converting the PC from a standalone management tool to an intelligent workstation within an integrated office. Expect more of the same.



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• TENANT SERVICES ACTION. The combination of divestiture and deregulation is making for some strange bedfellows. Ameritech (the RHC serving Michigan, Ohio, Indiana, Illionis, and Wisconsin) is teaming up with Satellite Business Systems' Realcom subsidiary to enter the burgeoning tenant service business. Over the next five years, Ameritech will supply Realcom with $100 million in telecom equipment (from various manufacturers) and provide installation and service tasks said to be worth another $80 million. Realcom contracts with the building owner and its tenants to provide voice, data, and video service. Literally dozens of companies, from AT&T to start-ups, have entered the tenant services business, including building management, communications, and real estate development companies.

• IBM WINS COMMUNICATIONS CONTRACT. IBM has won a multi-million dollar contract to build an internal telecommunications system for the the British postal systems. The value of the deal is not being disclosed.

• DBMS FOR 3B20. Oracle has announced the immediate availability of its relational DBMS for AT&T's new 3B20 mini. Oracle is a "SQL-compatible" scheme that runs on IBM mainframes, Vax minis and various PCs. Oracle is priced at $48,000 on the 3B20, $12,000 on "low-end" minis, and $96,000 on IBM mainframes.

• CDC, XEBEC SUPPORT DISK STANDARD. In a joint announcement, the two firms gave their support to the Enhanced Small Device Interface (ESDI) for 5.25" winchester drives. CDC and Xebec will work together on design verification and product qualification. The new standard is for high performance drives with requirement beyond those of the current ST506 interface. Major advantages of ESDI include data integrity, faster transfer rates, and a data separator in the drive, not the controller.

As part of its efforts to be a vertically integrated supplier, Xebec has signed a letter of intent to acquire the assets and business of Datapoint's Sunnyvale disk and tape manufacturing division, employing 320 people. Xebec will continue to provide disk products to Datapoint for use in its OA systems.

• NEC/HONEYWELL FINALIZE DEAL. Both Honeywell and Cii Honeywell Bull now have distribution and manufacturing rights for "certain NEC large-scale computers for a minimum of ten years." The main task now is to integrate NEC's S1000 CPU with Honeywell's GCOS 8 software, peripherals, and communications. Honeywell will market the machine in the U.S., Canada, Italy, U.K., and Australia. Cii gets the rest of Europe, the Mideast, and South America. S-1000 shipments by Honeywell are slated for the fourth quarter of 1985, system pricing has not yet been set. Honeywell expects to begin volume shipments of its delayed high-end DPS 88/81 this quarter.

• NEW OPTICAL START-UP. A former Computer Memories president and a Tandon VP have founded Laser Memory Systems (Calabassas, CA), with the focus on low-cost optical memory drives.

• OSBORNE RETURNS. Adam Osborne is entering the software publishing arena, with the emphasis on significantly lowering micro software prices.

• IBM BOOSTS INTEL SHARE. It's now 20%, up from 12% originally.

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● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA EDITOR MARCH 31, 1984 ● V/19, NO.23 P.J. MCGOVERN, PUBLISHER

IDC INTERNATIONAL DATA CORPORATION

AT&T shows 3B hardware -- Page 6

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A LOOK AT THE CHANGING DP LANDSCAPE, AS GRAY SHEET CELEBRATES 20th ANNIVERSARY

It was 20 years ago this week that the inaugural issue of the Gray Sheet gained immediate notoriety by revealing that IBM expected to ship 5,000 units of its then yet-to-be-announced System 360. Events later proved the treachery of market forecasts as Big Blue went on to ship 35,000 360 systems, establishing a de facto software standard that is still with us today.

Since then, the Gray Sheet has observed the steady decentralization of computing power -- in movements that uncannily track the rhythms of the decades. Mainframes, which arrived in the 1950s, took hold in the 1960s. Minis, created in the 60s, became widespread in the 70s. Micros, offspring of the 70s, have grown up in the 80s. In this issue, EDP/IR takes a look back at the changing players, markets, and technologies, while taking time out for the ironies, lessons, and delights of history. Some facts that help quantify the events of the last twenty years:

- In terms of user spending, the industry has grown 21-fold from $4.1 to $86.3 billion. This translates into an average compound growth rate of 16.5%. Over this time, inflation has averaged about 6%.

- Large system processing costs have fallen by some 14% per year. Disk storage has dropped even faster at 21%, and the price of a megabyte of semiconductor memory has fallen from $1.6 million in 1964 to about $10,000 today, a rate of 22% per year.

- The number of U.S. firms in the industry has grown from about 100 in 1964 to over 12,000 today, a growth rate of 27% per year.

- In terms of the value of worldwide shipments, IBM's overall hardware market share has fallen from about 75% in 1964 to 47% in 1982.

- Since the 1960s, Japanese firms have become much more important, and European firms less so. Six of the top ten independent chip makers are Japanese, and three Japanese firms are among the world's top ten information product firms. Europe is not represented on either list.

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TOP TEN U.S. INDEPENDENT COMPONENTS MAKERS

	Valves Pre-1955	Transistors 1955	Semiconductors 1965	Int. Circ. 1975	Int. Circ. 1983
1.	RCA	Hughes	Tex. Instr.	Tex. Instr.	Tex. Instr.
2.	Sylvania	Transitron	Motorola	Fairchild	Motorola
3.	Gen. Electric	Philco	Fairchild	Nat. Semi.	Nat. Semi.
4.	Raytheon	Sylvania	Gen. Instru.	Intel	Intel
5.	Westinghouse	Tex. Instr.	Gen. Elec.	Motorola	AMD
6.	Amperex	Gen. Electric	RCA	Rockwell	Fairchild
7.	Nat. Video	RCA	Sprague	Gen. Instr.	Signetics
8.	Ranland	Westinghouse	Philco	RCA	Mostek
9.	Elmac	Motorola	Transitron	Signetics	RCA
10.	Landsdale	Clevite	Sylvania	Amer. Micro.	Gen. Instr.

Source: The Economist; Semiconductor Industry Association.

LEADING U.S. COMPUTER COMPANIES, 1952-1983
(Copyright 1984 -- International Data Corporation)

	1952	1962	1972	1983 (U.S.)	1983 (worldwide)*
1.	Sperry	IBM	IBM	IBM	IBM
2.	IBM	Sperry	Honeywell	Burroughs	NEC
3.		CDC	Sperry	DEC	Tex. Instru.
4.		RCA	Burroughs	NCR	Burroughs
5.		NCR	CDC	CDC	Motorola
6.		Gen. Elec.	NCR	Sperry	DEC
7.		Honeywell	DEC	HP	NCR
8.		Burroughs	HP	Honeywell	Fujitsu
9.			Xerox	Wang	Hitachi
10.			Data Gen.	Apple	CDC

Notes: Rankings for 1952-1972 are based on value of worldwide shipments as estimated by IDC. 1983 rankings are based on computer industry revenues. Worldwide estimates include semiconductor and communications products.

For those who need a reminder of just how thorough a shakeout can be, consider this list of the key players in the minicomputer (then called special purpose systems) market in 1966. A list of the peripheral makers back then would include even more long-forgotten entities.

Adage	Advanced Scientific Instr.	Applied Dynamics
Astrodata	Beckman Instr.	Bunker Ramo
Collins Radio	Computer Control	Computer Products
Conductron	Data Machines	DEC
Electronic Assoc.	Foxboro	Milgo Electronic
Raytheon	Reeves Instrument	System Engr. Labs
Teledyne		

On the software side things have been a little more stable. The leaders back in 1966 were: Aries; Auerbach; ADP; Arthur Anderson; Applied Data Research; Bolt, Beranek, and Newman; Booz, Allen & Hamilton; Brandon Applied Systems; C-E-I-R; Charles Adams Associates; Computer Applications; Computer Sciences; Computer Usage; Comress; Diebold; Digitek; Informatics; Mesa Scientific; Planning Research; System Development Corp; and URS Corp.

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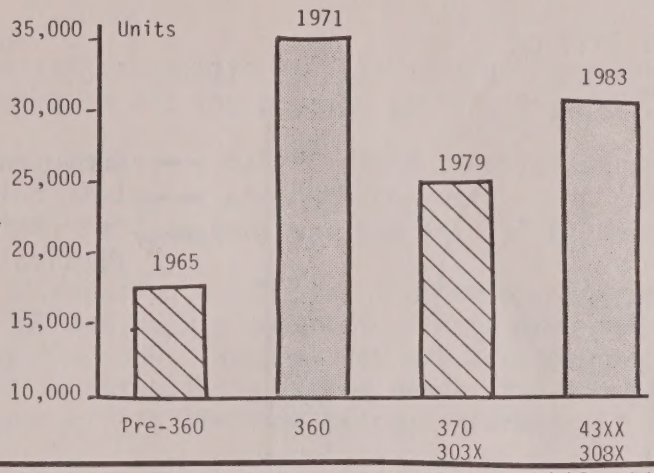
MAXIMUM WORLDWIDE INSTALLED BASE OF IBM GENERAL PURPOSE FAMILIES

(Copyright 1984 -- International Data Corp.)

The figures show the surprising fact that in terms of units, the 360 was the most popular mainframe of all time. But many of these were at the low end, where S/34s, S/3s and S/38s eventually took over.

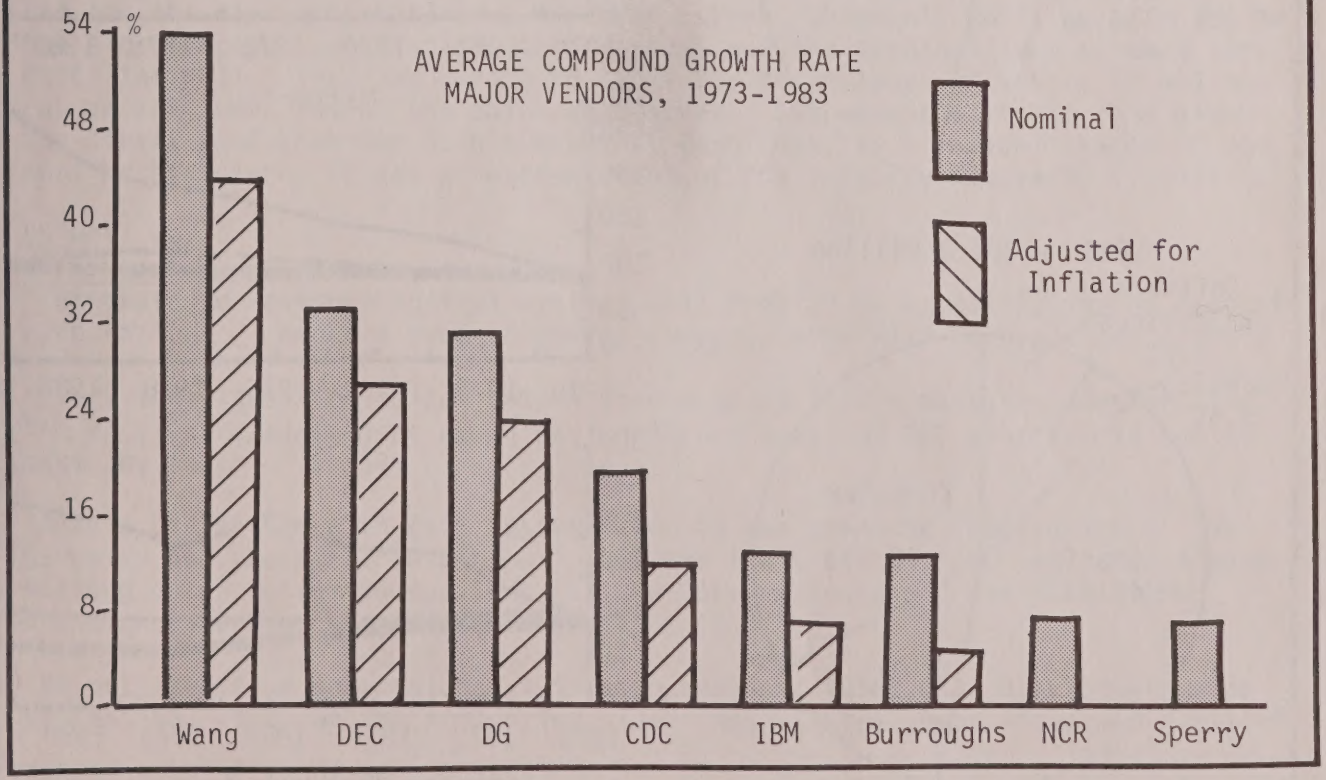


The product families are grouped on technology criteria. The 303X was not so much a family of its own as an extension of 370 thinking. Similarly, the 4300s and 308X are linked by common packaging techniques.

A HISTORY OF COMPUTER TECHNOLOGY, 1955-1983

	1955	1960	1965	1975	1983
Cost	$14.54	$2.48	47¢	20¢	7¢
CPU time	375 seconds	47 sec.	29 sec.	4 sec.	1 sec.
Technology	Vacuum tubes	Transistors	Solid Logic	Monolithic	VLSI
	Mag. Cores	Channels	Large disks	Memory	Thin film
	Mag. tapes	Fast cores	New channels	Virtual	Cartridge
				Storage	Tapes

Source: IBM. The figures show the time and cost for large IBM systems to complete a fixed amount of work, and are based on an identical mix of 1,700 typical DP operations, involving millions of instructions. Included is a cross-section of payroll, discount computation, file maintenance, table look-up, and report preparation. The figures are not adjusted for inflation.



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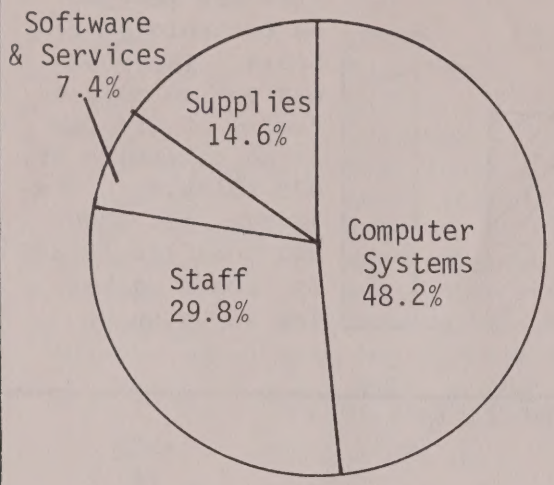
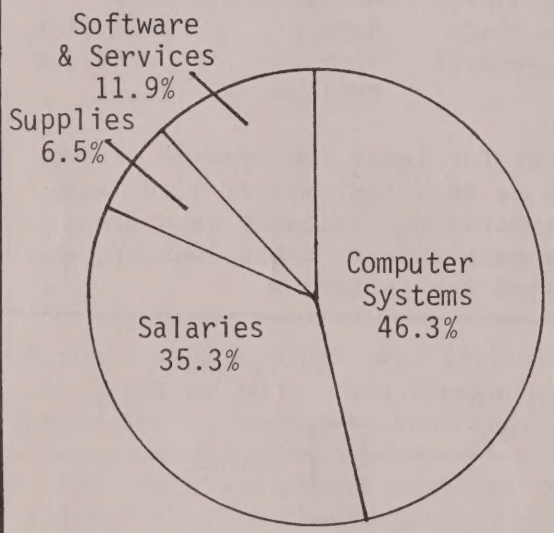
U.S. MIS USER SPENDING, 1963, 1973, 1983
(Copyright 1984 -- IDC)

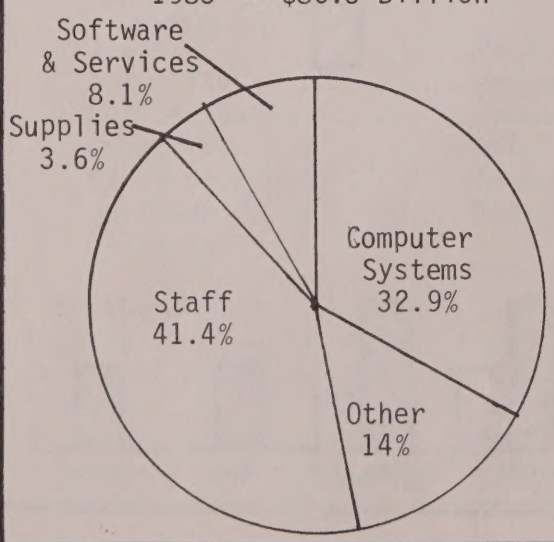
1963 -- $4.1 Billion



1973 -- $19.9 Billion

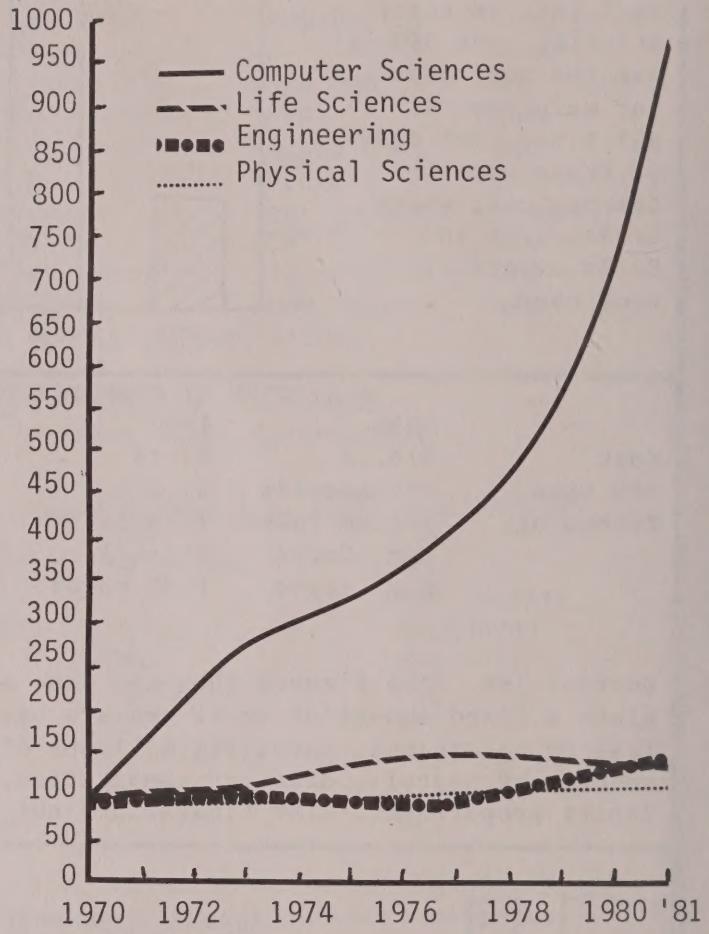


1983 -- $86.3 Billion

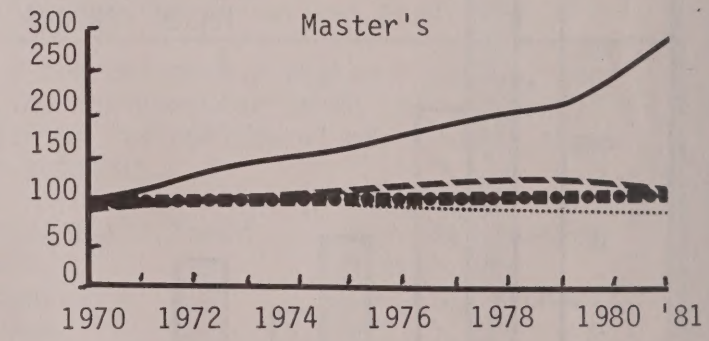


MEASURES OF U.S. COMPUTER TRAINING

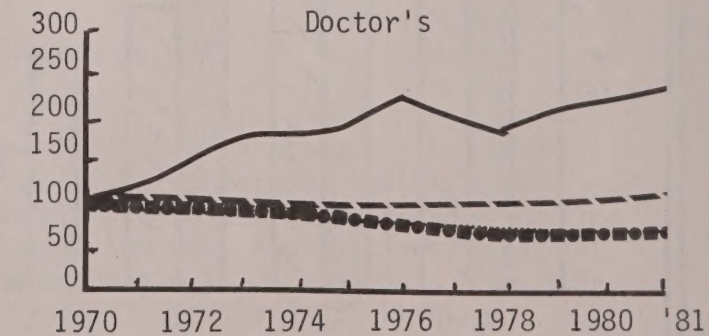
Bachelor's



Master's



Doctor's



Source: National Science Foundation

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THE MORE THINGS CHANGE ... (Selected quotes from EDP/IR, 1964-74)

Amen

"One of the problems CDC faces with its ultra-large computer program is that it appears to be dependent on its engineering genius, Seymour Cray." (1964.)

"Incompatibility among computers has resulted in needless duplication, delay and waste -- both to the manufacturer and the user -- in cost, in equipment, in operating efficiency, and in manpower and skills" (1964).

"RCA's reasons for introducing a computer line which can execute programs written for the System/360 are fairly apparent. First they are counting on widespread acceptance of the /360. Second they are counting on the prospect that many users will want to establish a second vendor relationship, particularly when the second vendor offers improved price/performance." (1964)

"This year confirms that a firm doesn't have to have the most advanced computers in order to capture a profitable share of the market." (1966)

"Optical scanning has been around for as long as the computer, but it still hasn't caught on except in specialized applications. This situation may be about to change, but there are still many uncertainties in the picture." (1967)

"A current instruction to IBM branch managers states, essentially: 'leasing companies are henceforth to be treated as competitors of IBM in every sense of the word.'" (1968)

"The scope of IBM's unbundling action was very broad indeed. The reduction in price, however, is very slight. Read IBM's announcement to mean a quite steep increase in user's data processing costs." (1969).

"As for the mini manufacturers, if their current shipments won't be affected by the microprocessor revolution, their prices and the eventual look of their product line will. They can choose to coopt the technology, or ignore it and focus on the lower end of the mainframe market. But when the 16-bit chip hits the street (and then the 32-bit machine) then look for a radical change in product architecture, if not a rearrangement of the industry hierarchy." (1974)

Oh well ...

"Integrated management control systems will finally be a reality in the largest corporations -- hence a good volume of (paper) forms will be bypassed." (1964)

"Every individual income tax return is now going into a massive computer file. The only way a person can avoid paying income tax, the IRS asserts, is not to make any income." (1967).

"Adapso has joined with Data Systems Inc. to sue both the Comptroller of the Currency and the American National Bank and Trust Co. Adapso says that a bank selling data processing services is 'non-banking business, not within the statutory grant of powers and unlawful.'" (1967)

"He outlined five generations: 1951- computation; 1958- DP; 1963- information processing; 1970- online processing; 1978- man's intelligent assistant (1974)."

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AT&T ENTERS COMPUTER BUSINESS
BUT SELLING MOSTLY TO OEMS AT THIS TIME

On March 27th, at 11:00 A.M., AT&T made its long awaited entry in the computer business with a line of open architecture, 32-bit minicomputers based on Unix System V. The products -- 3B2, 3B5, and 3B20 -- are available to VARs immediately, and span a performance range of 0.5 to 1.8 MIPS. An Ethernet local area network, a PC/DOS-to-Unix file conversion package, and a proprietary real-time/fault-tolerant version of Unix were also introduced.

AT&T now has a line of minicomputers structured and priced much like that of its principal competitor, Digital Equipment Corp. But showing its advanced technology, two of the three systems (roughly comparable to the Vax 730 and 750) are microprocessor-based and use 256K memory chips. At this time, the systems are designed primarily for dumb, low-cost, asynchronous, Teletype terminals. No personal computers or intelligent workstations have been announced.

Significantly, AT&T's initial marketing efforts are focused on value added resellers (VARs) and on those large users sophisticated enough to handle most of their own software needs. Although AT&T says that many software announcements are coming, at this time the company is heavily dependent on third parties for applications and data base support. Some key points:

- Marketing. AT&T Information Systems will sell the 3B systems to end users and commercial VARs; AT&T Technologies will sell to industrial and technical VARs; and AT&T Network Systems will sell to the telephone companies. Additionally, both AT&T International and Olivetti will market the systems internationally.

- Open architecture. At least for the 3B2, AT&T has pledged to publish the internal bus structure to create an open architecture. Unix System V specs should serve a similar purpose for software.

- Reliability. AT&T says its products are at least 50% more reliable than today's commercial system, and it claims that its 3B20D fault tolerant system will go down 2 minutes per year. Additionally, the 3B family can work at temperatures ranging from 32 to 122 degrees F.

- Networking. 3BNet is an Ethernet implementation. The user has two network interface options; a three-board AT&T set (based on the WE 32000) for $7,000, or a one-board device (from either Intel or Seeq) which costs much less. The AT&T version includes administrative and maintenance tasks and promises better performance and flexibility.

- Communications. There is no support of SNA, and little PBX integration. Additionally, there is no ability to tightly couple multiple superminis (a la Tandem), or dynamically allocate workloads. Interprocessor communications is via loosely coupled X.25 links

- Software. The fault-tolerant 3B20D comes with a proprietary, real time extension of Unix (RTR). RTR requires some "minor modifications" to Unix V software, particularly in the area of system calls.

- PC interface. From work with Locus Computing, AT&T can convert PC/DOS to Unix files on the 3B2 only (no price yet, available 3rd qtr.).

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AT&T TECHNOLOGIES -- COMPUTER PRODUCT LINE

Model	3B2/300	3B5/100	3B20S
Max. Users	18	40	300
Processor	WE 32000	WE 32000	Bit sliced
Main Memory	0.5 - 2MB	1-8MB	Up to 12MB
MIPS	0.5	0.6	1.0
Disk Storage	10-32MB	134-160MB	300MB
I/O Basic	Two RS232-C	8 RS232-C	2-4 Channels
Power Consumption	200 Watts	1,360 Watts	4,100 Watts
First Installed	1984	1983	1981
Price (basic)	$9,950	$57,000	$230,000
(includes)	0.5MB memory 10MB disk, 4 I/O	1MB memory, 48MB disk, 1 asynch port	2MB memory, 300MB disk, tape drive 8 ports, printer
Price (configured)		$100,000 4MB, 320MB tape, controller	$330,000, 4MB, 900MB, tape, cont., printer

Notes: The 3B5 also comes as the Model 200 using a faster version of the WE 32000 that runs at about 0.8 MIPS; AT&T claims it can support up to 60 users. The /200 costs $16,000 more than the /100 for similar configurations. The 3B20S can be upgraded (add $100,000) to the 3B20A attached processor (1.8 MIPS), but not the 3B20D dual CPU fault-tolerant system ($340,000).

Comments

Although AT&T has been criticized for not giving any evidence of it ability to deliver in quantity, the company has said a few things about the size of its workforce that suggests significant plans. ATTIS president, Bob Casale, notes that by year-end AT&T will have 2,000 trained software technicians and 6,000 support people at two centers in New Jersey and Colorado.

In answering charges about lack of software, AT&T points out that there are some 300 applications available from third parties (50 accounting, 15 graphics, 13 spreadsheets). But these products are neither available from nor endorsed by AT&T, and many have not been widely tested in the marketplace. Unless the Digital Research/AT&T Unix library project is successful, the application software problem will persist. AT&T notes that it has now sold some 2200 Unix source licenses, and that Unix is running on 70,000 computers of 70 types.

In terms of price/performance, AT&T seems to be competitive with DEC, but not particularly aggressive. After all, DEC is hardly the price/performance leader these days. At the high end, a one-MIP supermini is nothing special; DG and Prime have uniprocessors in the 2.5 MIP range. The low-end products seem more aggressively positioned. AT&T has established a slim technological lead in its use of 32-bit chips and 256K RAMs. EDP/IR hasn't seen any other vendor claim to support 60 users with a microprocessor system, but this capability has yet to be tested in the marketplace.

AT&T has two clear selling points. It is the only major vendor totally committed to Unix, and it claims unmatched reliability. But until it enters the end user market, and until it proves it can win in head-to-head bids vs. its minicomputer competitors, its overall impact will be limited. A late entry into a highly competitive market is never easy.

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IBM GETS BACK INTO TAPE BUSINESS WITH 200MB CARTRIDGE DRIVE

Having lost over half of the high end tape drive market to Storage Technology over the last few years, IBM finally unveiled its eternally rumored CrO2 3480 cartridge tape drive. Offering 20% more data in about one-third the area of a 10.5" reel, the drive cuts space and power requirements by 60%, can transmit at 3MB/sec, and has a 512K buffer. IBM promises simplified handling, fewer mismounts, and greatly reduced cleaning requirements. Depending upon block size, performance improvements range from little to more than double.

That said, there are some negatives. Contrary to much of the pre-announcement speculation, the system cannot run off the 3880 controller, and the need for an expensive new tape controller has led to a $237,000 8-drive 3480 system price some 30% higher than the 3420 Model 8 it succeeds. This higher than expected price, as well as a 1985 general availability date, has given STC and Memorex more breathing room than they had expected.

Additionally, the 200 MB cartridges still don't meet the need for a large, archival device to back up a 1.2GB 3380. This will please STC which hopes its optical drive will fill this role. IBM could at least partly address this issue by introducing some type of automatic loader/stacker. Sales of IBM's 3850 mass storage device were virtually wiped out by the arrival of the 3380.

In a familiar refrain, IBM says that the 3480 is best suited for its large customers, and that the 3420 and 3430 are still recommended for intermediate systems and less demanding tasks. Consequently, there have been no price cuts on these older systems. Over time, EDP/IR expects the cartridge technology to move down to lower performance units.

Certainly, the two tape technologies will coexist for some time. At $15 per cartridge, the time and expense of converting tens of thousands of 10.5" reels would be prohibitive. IBM sees the migration occurring on an application-by-application basis, as part of normal processing operations, i.e., a 10.5" reel as a master-in, and a 4"x5" cartridge as a master-out.

Currently, the 3480 is fully supported only under MVS, with VM "compatibility support." But an IBM spokesman noted that the differences here are very minor, and only exist when VM is being used in native mode, and only then for a small subset of functions. DOS is not supported at this time.

A more interesting software aspect is the announcement of the Data Facility Hierarchical Storage Manager (DFHSM) version 2. This program is designed to assist in the automatic migration of data from tape to disk, optimizing according to planned activity and response time requirements. To quote IBM, "DFHSM's expanded storage hierarchy is part of the evolution towards the system-managed storage environment of the 1980s."

An STC executive noted that the DFHSM is attempting to do through software what STC's abandoned Virtual Storage System (VSS) hoped to do via a dedicated Magnuson 4300-size CPU. According to the official, the problem with the STC system was that it was too expensive: there was demand for such a product and the technical aspects were manageable. IBM's software approach may prove more viable, he added. Both STC and Memorex are working on cartridge technology, the latter most likely through its relationship with Fujitsu.

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Amdahl counters IBM moves -- Page 6

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1984 U.S. MIS SPENDING TO REACH $97.8 BILLION; MICRO AFFECTS CENTRAL DP ROLE MORE THAN IT DOES OVERALL SPENDING

Even though U.S. businesses will spend more than $9 billion this year for personal computers, central MIS department spending continues to snowball. International Data Corporation's annual user spending survey indicates that MIS departments expect their total spending to rise 13% in 1984, reaching an impressive $97.8 billion. 1983 spending grew 15% over 1982's $75 billion.

Discussions of whether the micro will help or hurt MIS spending are often academic. Consider the fact that nearly 20 years after the arrival of the minicomputer, its effect on mainframe spending is still a matter of debate. Like minis, micros create new users and demand, while taking away some old mainframe applications. But through the pulling and tugging, MIS fundamentals -- batch and on-line transaction processing systems, centralized data bases, and corporate communications, control and security -- remain largely intact.

In short, the micro has had more of an effect on the MIS department's role, attitude, and orientation than it has on MIPS, gigabytes, and code. The demand for large system processing and storage continues to grow faster than historical rates would predict, and elasticity hasn't lost its touch. A few notes:

- According to those surveyed, the fastest growing MIS spending sectors in 1984 will be packaged software (31%), communications (28%), and systems hardware (19%). Slower moving sectors will include personnel (just 6%), data entry equipment (8%) and timesharing (0%).

- A 1983 IDC survey indicates that 32% the MIS departments in Fortune 1,000 organizations are purchasing PC's for end user applications.

- Major hardware and software vendor U.S. revenues grew some 16.7% in 1983. If IBM is taken out of the picture, revenue growth was only about 10.1%. Due to the strength of the dollar and lukewarm demand, international growth was only 8.7%, 3.7% for the non-IBM world.

- 71% of the organizations surveyed do not have significant chargeback systems in place, and only 18% chargeback 50% or more of their costs.

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U.S. MIS DEPARTMENT SPENDING, 1982-1984 ($M)
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	$ Spending 1982	% Budget 1982	% Growth 82/83	$ Spending 1983	% Budget 1983	% Growth 83/84	$ Spending 1984	% Budget 1984
Rental & Lease Payments	11,980	16.0	16	13,884	16.0	14.8	15,938	16.3
Depreciation for Purchased Equip.	4,160	5.5	29	5,366	6.2	31	7,030	7.2
Maintenance and Other Charges	3,495	4.7	22	4,276	4.9	15.9	4,955	5.0
SUBTOTAL	19,635	26.2	20	23,526	27.1	19	27,923	28.5
Data Entry Equip.	765	1.0	-20	612	0.7	-10	551	0.6
Terminals & Term. Controllers	3,475	4.6	15	3,996	4.6	11	4,436	4.5
Other	400	0.5	10	440	0.5	10	484	0.5
SUBTOTAL	4,640	6.1	9	5,048	5.8	8	5,471	5.6
Software Use Charges by Computer Mfgs.	1,734	2.3	25	2,168	2.5	11	2,406	2.5
Software Use Charges by Independents	1,184	1.6	50	1,776	2.1	56	2,770	2.8
Custom Prog./Cnsltg.	1,319	1.8	26	1,662	1.9	27	2,111	2.2
Timesharing/Services	1,072	1.4	3	1,104	1.3	0	1,104	1.1
In-house Soft. dev.*	261	0.3	10	287	0.3	21	347	0.4
SUBTOTAL	5,570	7.4	26	6,997	8.1	25	8,738	9.0
Tape Reels, Disk Packs, Floppies	510	0.6	25	638	0.7	20	766	0.8
Computer Forms	2,000	2.7	9	2,180	2.5	7	2,333	2.4
Cards, Ribbons, etc.	285	0.4	10	314	0.4	0	314	0.3
SUBTOTAL	2,795	3.7	12	3,132	3.6	9	3,413	3.5
Voice Communications (Equip. & Lines)	2,830	3.8	11	3,113	3.6	10	3,424	3.5
Data Communications (Equip. & Lines)	3,430	4.6	30	4,459	5.2	40	6,243	6.4
SUBTOTAL	6,260	8.4	21	7,572	8.8	28	9,667	9.9
Salaries	28,910	38.5	10	31,747	36.8	6	33,495	34.2
Travel	700	0.9	15	805	0.9	10	886	0.9
Training	350	0.5	33	466	0.5	15	536	0.5
Other	2,415	3.2	15	2,780	3.2	10	3,058	3.1
SUBTOTAL	32,375	43.1	11	35,798	41.4	6	37,975	38.7
Rent, Utilities, Other Overhead	2,480	3.3	13	2,802	3.2	11	3,110	3.2
Other	1,310	1.7	8	1,415	1.6	7	1,513	1.5
SUBTOTAL	3,790	5.0	11	4,217	4.8	10	4,623	4.7
GRAND TOTAL	75,065	100.0	15	86,290	100.0	13	97,810	100.0

*Note: In-house software development was an attempt to get data on new application development, but, given the small figure, it doesn't seem to have worked.

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SEGMENTATION OF U.S. MIS DEPARTMENT SPENDING, 1977 & 1984
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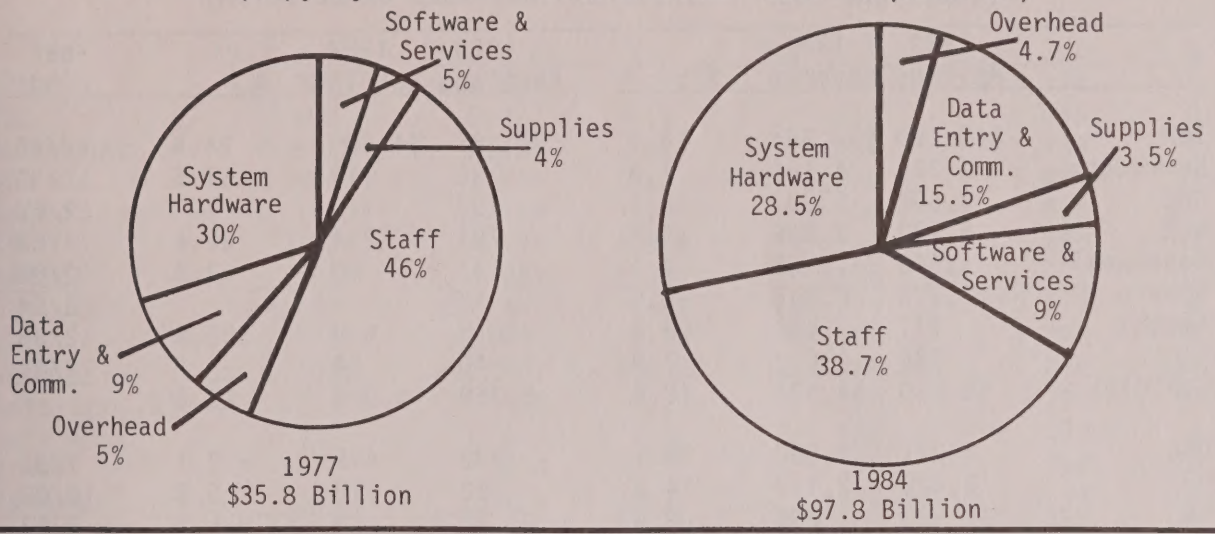
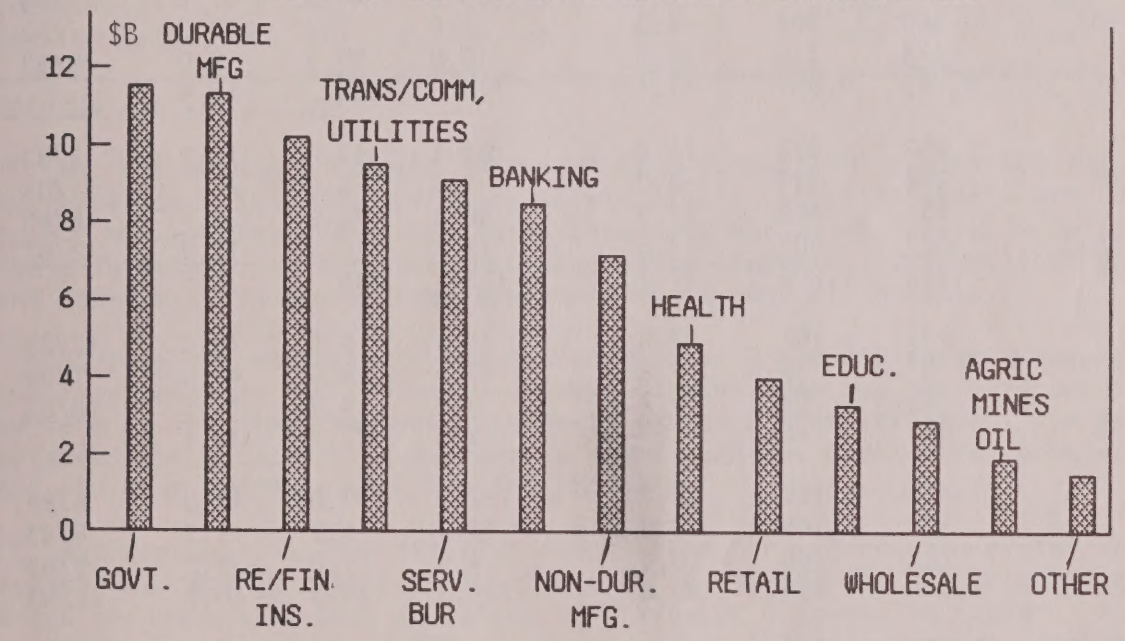


U.S. MIS DEPARTMENT SPENDING BY INDUSTRY 1983



The decline of the timesharing market continues. Even with the recession behind us, spending continues to drag; 1983 growth was just 3% and users expect 1984 spending to be flat. On the other hand, spending for third party software continues to explode with growth of 50% and 56% for 1983 and 1984 respectively.

On the personnel front, the survey indicates that in 1983 the number of MIS employees grew 2%, as spending for salaries rose 10%. The situation for 1984 is more puzzling. Users report that their staffs are expected to grow by 4% this year, but overall salary expenditures are only expected to grow 6%. Given normal merit increases, this 6% figure appears unrealistically low.

Despite IBM's emphasis on purchased systems, users are still leasing lots of hardware from manufacturers, third parties, and IBM Credit Corp. Although depreciation expenses are growing faster than lease payments (31% to 15%), in 1984, rent and lease expenses will be more than twice those for depreciation.

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REVENUES AND EARNINGS, SELECTED MAJOR VENDORS, 1982-1983
(Copyright 1984 -- International Data Corporation)

	1983 Revenue	1982 Revenue	%	1983 Earnings	1982 Earnings	%	Year End
IBM	$40,180	$34,364	16.9	$5,485	$4,409	24.4	12/83
Burroughs	4,389	4,186	4.8	196	117	67.5	12/83
CDC	3,507	3,301	6.2	153	142	7.7	12/83
NCR	3,730	3,526	5.8	287	234	22.6	12/83
Honeywell	1,666	1,685	-1.1	131	80	63.8	12/83
Sperry	2,875	2,818	2.0	--	--	--	3/84
Amdahl	777	462	68.2	46.5	6.8	583.8	12/83
STC	886	1,079	-17.8	-40	64	--	12/83
SUBTOTAL	58,010	51,421	12.8	6,258	5,053	23.8	
DEC	4,271	3,880	10.1	283	416	-32.1	7/83
HP	2,420	2,117	14.3	392	370	5.9	10/83
DG	828	805	2.9	23.1	24.7	-6.5	9/83
Prime	516	435	18.6	32.5	44.9	-27.6	12/83
Datapoint	340	508	6.3	8.0	2.4	233.3	7/83
Tandem	418	312	34.0	30.8	29.9	3.0	9/83
SUBTOTAL	8,793	8,057	11.6	770	889	-13.4	
ADP	752	677	11.0	64.5	57.0	13.2	6/83
Tymshare	288	297	-3.0	-1.6	8.8	--	11/83
EDS	651	409	27.9	58.6	46.9	24.9	6/83
Comp. Sc.*	527	503	4.8	11.1	13.2	-15.9	12/83
SUBTOTAL	2,218	1,986	11.7	133	126	5.5	
MSA	145	101	43.6	10.8	9.0	20.0	12/83
Cullinane*	84.8	55.0	54.2	11.6	8.0	45.0	1/84
ADR	89.0	68.4	30.1	7.0	4.7	48.9	12/83
SUBTOTAL	319	225	41.7	29.4	21.7	35.4	
Wang	1,538	1,159	32.7	152.0	107.0	42.0	6/83
CPT	178	145	22.8	17.7	15.9	11.3	6/83
NBI	120	100	20.0	4.6	11.0	-58.2	6/83
SUBTOTAL	1,836	1,404	30.8	174.3	133.9	30.2	12/83
GRAND TOTAL	71,176	63,093	12.8	7,364	6,223	18.4	
Less IBM/ Amdahl/STC	29,333	27,188	7.9	1,873	1,743	7.4	

Notes: Revenue figures are for computer businesses only. The only significant double counting between the vendors occurs with CDC's billion dollar peripherals business, much of which is resold by the minicomputer and Bunch companies. Hewlett-Packard data includes revenues from calculator business. HP and Honeywell earnings are before taxes.

Sperry does not end its fiscal 1983 until March 31; its 1983 revenue figure is EDP/IR's estimate. Additionally, Sperry does not break out the earnings contributions of its major business lines, although 1983 information systems profits are believed to be up 30%-40% over the low levels of 1982. Figures from Computer Sciences, Cullinet, and Applied Data Research are for the nine months ending at the date indicated.

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INFORMATION PROCESSING REVENUES, U.S. vs. INTERNATIONAL ($M)
(Copyright 1984 -- International Data Corporation)

	1983 U.S.	1982 U.S.	%	1983 Int.	1982 Int.	%
IBM	$23,127	$19,028	21.5%	$17,053	$15,376	11.2
CDC	2,900	2,717	6.7	1,051	1,045	0.6
Burroughs	2,622	2,448	7.1	1,767	1,738	1.7
NCR	2,275	2,045	11.2	1,455	1,481	-1.8
Honey. (est.)	1,116	1,129	-1.1	550	556	-1.1
STC	710	794	-10.6	177	285	-37.9
Amdahl	491	285	72.3	286	177	61.6
Subtotal	$33,241	$28,446	16.8%	$22,339	$20,618	8.3%
DEC	2,770	2,497	10.9	1,502	1,383	8.6
Wang	1,103	801	37.7	435	358	21.5
Data General	569	570	0.2	260	236	10.2
Datapoint	353	329	7.3	187	179	4.5
Prime	322	274	17.5	195	162	20.4
Tandem	297	215	38.1	120	97	23.7
Subtotal	$ 5,414	$ 4,686	15.5%	$ 2,699	$ 2,415	11.8%
Grand Total	38,655	33,132	16.7	25,038	23,033	8.7
Non-IBM Total	15,528	14,104	10.1	7,985	7,697	3.7

Information center use

That MIS hardware budgets increased by a strong 20% in 1983 and 19% in 1984 suggests that the DP center is still wielding a lot of influence over end user computing spending. Although the survey does not break out hardware components in detail, it is a clear that personal computers, information centers and other distributed systems are included in many MIS budgets.

IDC research shows that some 32% of Fortune 1,000 MIS departments are actually purchasing PCs for end user applications. As the MIS department begins to take on training, software, and maintenance responsibilities, its micro-related expenditures will further increase, and the distinction between MIS and end user spending will continue to blur.

Last November, an IBM official responsible for information center activities told EDP/IR that IBM expected that by the end of 1984 some 60% of its large accounts will have installed some type of information center. According to IDC's annual survey of IBM mainframe sites, this may prove conservative.

The IDC data (based on responses from over 1,000 370-type sites) indicates that at the end of 1983, 59% of the IBM 308X sites had something that they called an information center. Interestingly, the percentages drop off rapidly for 303X and 4300 systems. These facts lead to the following conclusions:

- Despite the growth of VM/CMS, most information centers are MVS and 308X based. Fourth generation languages need lots of horsepower.
- Although IBM and independent data base management vendors have pushed the idea of creating dedicated end user data bases with dedicated hardware, this has not happened to any measurable extent.
- Users who want to build an interactive decision support system for end users are often considering minicomputer alternatives.

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AMDAHL RESPONDS TO IBM 308X MANEUVERS, ADDS NEW DISKS;
FUJITSU UPS STAKE TO 49.5%

Between Amdahl and National Advanced Systems, the high end plug-compatible CPU marketplace in the U.S. and Europe was worth some $900 million in 1983, more than any of the Bunch companies earned from their similar class machines, and about 10% of IBM's class six and seven (308X) business. (IDC's actual 1983 figures for IBM shipments will appear soon in EDP/IR.)

As their businesses have grown, (Amdahl at 18.5% per year since 1978), both companies have become increasingly important outlets for their Japanese OEMs, Fujitsu and Hitachi respectively. Amdahl has a larger high end installed base than Fujitsu does in Japan, and NAS claims to be taking 50% of Hitachi's 9000 series output. Additionally, the U.S. PCM outlets are growing significantly faster. Since the market for large 370-type machines in the U.S. is about five times larger than in Japan, there is much more room to grow.

As mainframe development costs continue to increase, it is clear that some level of success in the U.S. and European markets will be essential if Fujitsu and Hitachi are to profitably remain in the high end IBM mainframe business. Within the Pacific Basin, fast growing economies such as Korea, Taiwan, Singapore, etc., still have relatively few organizations large enough to need 308X class systems, although this is changing.

Thus, it is not surprising that Fujitsu has upped its stake in Amdahl from 30% to 49.5% (effectively killing the AT&T/Amdahl rumors). In 1983, Fujitsu shipped $159 million in mainframe subassemblies to Amdahl (up 60% over 1982). Additionally, Amdahl sold some $100 million worth of Fujitsu disks in 1983, and around $20 million worth of communications gear (primarily Amdahl's 4705).

Amdahl sales of other Fujitsu products are likely. EDP/IR expects that Amdahl will eventually start selling Fujitsu's supercomputers which are designed to work with IBM systems. Whether Amdahl's Aspen operating system will borrow from Fujitsu's sophisticated MVS-like efforts remains to be seen. Fujitsu tape or other mass storage products are also a logical possibility, especially after IBM introduces its long-awaited tape system.

New CPUs and disks from Amdahl

Amdahl has recently countered IBM's new 308X line-up by cutting 5860 purchase prices by 3% to 14%, by bumping up 5850 performance by 5% to 7%, and by introducing two new models -- the dual processor 5867 and multiprocessor 5868. No new hardware has been created. The new machines, which flesh out the high end of the line, are downgraded versions of the 5870 and 5880, respectively. Unlike IBM's new systems, 580 users can upgrade to the new systems.

Perhaps equally significant is Amdahl's new 3380-type disk. The company has added the dual pathing 6380 (Fujitsu's 10.5" Eagel II) to its 3350-type 6280. As STC, CDC and Memorex struggle to get their 3380-class drives out in any kind of volume, there is a chance for both Amdahl and NAS to gain some market share, especially as IBM continues to ship all the 3380s it can build.

A spokesman said that it expects solid demand for both the 6380 (available in the third quarter) and 6280. The 6380 will go to those most concerned with capacity while the 6280 will go to those who need performance. Since the 6280

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CURRENT IBM/AMDAHL LARGE SYSTEMS
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Model	Mem/Chan.	Purchase Price	Monthly Rental	Monthly* Maintenance	IDC Perf. Rating
IBM					
3084QX	64/48	$7,582,500	$424,000	$11,520	1,350
3081KX	24/16	3,845,500	201,000	5,630	750
3081GX	24/16	3,315,500	176,500	5,090	545
3083JX	16/8	2,530,500	123,500	4,730	396
3083BX	16/8	2,005,500	86,500	3,760	296
3083EX	16/8	1,390,500	56,500	3,410	198
4381-2	16/6	620,000	41,500	840	133
4381-1	16/6	490,000	33,000	730	100
Amdahl			2-year lease		
5880	64/48	$5,660,000	$286,000	$20,715	1,085
5870	32/24	4,370,000	222,500	17,850	1,050
5868	32/32	4,070,000	207,650	13,950	868
5867	24/24	3,560,000	181,195	12,700	775
5860	24/16	2,760,000	140,000	10,250	620
5850	16/16	2,350,000	119,900	8,500	465
5840	16/16	2,000,000	102,045	8,200	372

Notes: Processor prices include all necessary power and cooling units, i.e. IBM CPUs include 3082, 3089, 3087, and 3278, except 4381s which require only a 3278. Amdahl says it may raise lease prices and lower maintenance. 5880, 5870, 5868, and 5867 shipments begin in second half of 1984. As of press time, NAS' response was still in the works. Both IBM and Amdahl charge $20,000/MB main memory and 150,000 for an extra 8 channnels. * Amdahl maintenance prices are for round-the-clock service and include operating system and access method software maintenance, and thus can't be directly compared to IBM's 9-5 service

has only 317MB per actuator, access is often faster than with the 3380-types which have 630MB per actuator. Both the 6280 and 6380 used advanced ferrite -- not thin film -- heads, they also use particulate media.

Fujitsu buys out Heizer, shows /XA lookalike

As Amdahl becomes a major outlet for Fujitsu peripherals, it becomes clear why Fujitsu nixed the proposed Amdahl/Storage Technology merger of 1980. Not only would STC peripherals have gone into the Amdahl salesforce, but Fujitsu's 30% interest in Amdahl (owned since 1972) would have shrunk to 15%. To up its share to the controlling 49.5% interest, Fujitsu bought all the shares of Heizer Corp., one of Amdahl's original venture capital supporters. Last year, Fujitsu bought out TRW's stake in the struggling TRW-Fujitsu Co.

Fujitsu, incidentally, has begun deliveries of its 31-bit operating system (called OSN/F4 MSP E20) which supports dual disk paths and the use of a common data base by multiple systems. The MVS/XA competitor is already installed at some 25 user sites, including Kyoto University, Kawasaki Steel, and others. According to IDC's EDP Japan Report, Fujitsu hopes to have 100 customers by September, a rapid installation rate. The company claims that it developed this software on its own and that it is highly efficient. Whether Fujitsu's software payments to IBM cover MSP E20 is not known at this time.

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• TRILOGY ANNOUNCES MORE DELAYS. Mid-1986 is the latest target. The company has also simplified its wafer designs forcing it to go to a dyadic processor to achieve its performance goal of three times the IBM 3081KX. Trilogy originally hoped to ship its product by mid-1984. The longer the delays, the more the cost advantage of its new technology diminishes. Trilogy needs more money, but Dr. Amdahl seems determined that it won't come from the Japanese.

• POT CALLS KETTLE BLACK. There must have been a few wry grins at the FCC when Satellite Business Systems (jointly owned by IBM, Comsat and Aetna) complained that AT&T was trying to offer bundled communication services that would exclude competition. Not only has IBM been challenged on similar grounds (bundled software), but SBS itself has petitioned the FCC to allow it to work directly with IBM, triggering many of the same concerns among SBS competitors.

The SBS complaint centers on AT&T's proposed shared facility version of its Enhanced Private Switched Communications Service (EPSCS), which offers custom switching, traffic management, and billing software. According to SBS, the plan would forbid customers from using carriers other than AT&T. SBS wants to stop AT&T from offering the service until the FCC has time to investigate.

• HARRIS REASSURES LANIER CUSTOMERS. Harris says that it fully intends to allow users of Lanier office automation equipment to migrate up into Harris' systems and networks. Local area network connections, shared storage, protocol conversion, and terminal emulation are all part of the solution. Harris acquired Lanier last October and estimates that there are some 55,000 of Lanier's No-Problem workstations installed.

• US WEST GETS INTO NETWORK MANAGEMENT. The old Bell Operating Companies continue to show willingness to compete in areas outside of plain old telephone service. U.S. West, through its Interline Communications Services subsidiary, hopes to offer nationwwide network management, installation, and maintenance to Fortune 1,000 companies, hoping to reinstate the single point of contact that was lost with divestiture.

• FUJITSU CLAIMS ROBOTICS BREAKTHROUGH. The company claims that its new Variable Compliance Mechanism (VACOM) allows a robot's wrist to perform tasks with 200 times more precision than was previously possible. The VACOM is said to be particularly good at inserting disk heads into spindles, a delicate task which has previously required human hands.

• START-UP TO MAKE SPUTTERED MEDIA. Cyberdisk, Inc. (Anaheim, CA), has received some $4 million in venture capital to make sputtered media disks for use with small winchester drives. Sputtering is a vacuum process employing plasma physics that uniformly applies material to a surface. Its chief advantages are lower contamination levels and improved product consistency. Principals come from Sierracin, Micromask, Century Data Systems, and Kearney Magnetics (formerly Xerox Magnetics).

• KAYPRO TO USE SEAGATE HALF-HEIGHT 12MB DRIVES. This $25 million deal (over 18 months) should help Seagate adjust to IBM's reduced winchester orders.

• SIEMENS TO SOURCE INTEL 286. Mid-1984 shipments will go to Europe first.

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"The Gray Sheet"

EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

DAVID MOSCHELLA, EDITOR FEB. 29, 1984 ● V/19, NO.21 P.J. MCGOVERN, PUBLISHER

IDC INTERNATIONAL DATA CORPORATION

SNA update -- Page 4

IBM JUGGLES 308X LINE; 5-14% PERFORMANCE BOOST TAKES PLACE OF PRICE CUT

As a mid-life kicker, it was just a nudge. Numbers in the 5-14% range sound more like price cuts than performance increases, and that's effectively what this latest IBM announcement seems to be, a price cut cloaked in new hardware.

But there could be more to this announcement than meets the eye. IBM does not have a history of shutting down a high-end production line for two months (forcing slipped 308X deliveries) and creating major user confusion in exchange for trivial performance improvements. Migration plans, especially at the high end, have now been complicated, and expectations for Sierra muddied.

Current 308X users don't have any major gripes, just a lot of insecurity. They don't know whether these new machines are something to get in on, or just an illusion to be wiped away by a new series. They are also a lot more skittish about what their old 308X systems are worth than they would be if IBM had merely cut 308X prices. Many have just got their systems, especially the 3083s, and most would like some explanation. Among six of the more viable:

- The changes (faster cycle times and one less TCM) were reasonably inexpensive, and thus it was more attractive to add power than cut prices. IBM must still build the older 308X engines for user upgrades.
- Just as IBM introduced lots of new 4300 models without any hidden tricks, this move may be a real ho-hummer that signifies little.
- The Sierra series might be late, and to maintain shipment rates IBM wants to tell users the 308X line is alive and well;
- The new processors may have features as yet unseen. Upgradeability to Sierra or better support of MVS/XA are remote possibilities.
- The small performance boost (5-10% under MVS and /XA, 5-14% under VM/SP) might please some customers unhappy with /XA's performance.
- The 3083 EX puts a little more room between the 308X and 438X lines.

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About the new processors

IBM replaced its entire 308X line with six new processors (3083 EX, BX, JX, 3081 GX and KX, and 3084 QX) that offer 5-14% performance improvements at the same purchase and lease prices as their predecessors. Maintenance prices have been lowered 15% on both the old and new systems. The old systems can't be upgraded to the new, but the old migration paths are still available at proportionately lower prices. Both the old and new lines support the same expanded memory capacities (now 64MB on the 3081s and 128MB on the 3084s) and software. The new models are being shipped, with the old engines only built for upgrades.

The main difference between the two lines is that the cycle time has been cut 8% from 26 to 24 nanoseconds; there are three less TCMs in the 3081 (from 26 to 23); there is one less board; and some internal parts have been merged. Both machines use the same TTL logic circuits

A little history

In 1972, when IBM introduced the 370/158 and /168 to replace the 155 and 165 announced just two years earlier, it offered performance improvements in the 25% to 40% range, and threw in MOS memory and virtual storage to boot. Many 155 and 165 customers, especially those who had bought rather than leased, were less than pleased as the residual values of their systems plummeted.

IBM has in recent years reaffirmed its ability to change its tune. Remember that when /XA was first announced, IBM said that /XA was only for its largest customers. Now it is gleefully singing that /XA is for everyone. Similarly, when IBM introduced the 3081D, it talked up the high end in order to maintain 303X sales. It announced the 3083s 16 months later.

EDP/IR does not think that history is about to repeat itself. To excuse the 158/168 manoeuvre, IBM could always claim "We've always said that leasing provides more flexibility than purchasing," but now with its push to purchase, IBM would be shooting itself in the foot if it punished its customers for following IBM's own advice and incentives. Additionally, EDP/IR doesn't see an upgrade from the new machines to Sierra as being in IBM's best financial interest.

IBM mainframe points of note

With the introduction of these new machines, it's a good time for a quick overview of what's happening with IBM's high-end business. IDC's latest 308X shipments and annual migration study combined with published IBM and other vendor statements produce the following observations.

- At the end of 1983, there were some 2,100 308X machines installed in the U.S. About the same number of 303X CPUs are still in use.

- User migration plans for 1984 suggest considerable interest in the 3084. 11% of the 30XX users that were migrating to a larger system are going to a 3084. If the sample held for the real world, 3084 sales in the U.S. for 1984 would be about 160.

- IBM reports that it now has sold over 600 MVS/XA licenses, a little less than 20% of its worldwide 308X base. Not bad for a product that has only been out one year.

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- As noted before (see EDP/IR 1/13/84, P. 2), IBM says it expects sales of 308X engines to rise 18% in 1984, but a high rate of upgrades makes it difficult to translate this into revenues.

- In its 1983 annual report, IBM notes that U.S. sales and rental revenues from its large processors (4300, S/38, 308X) rose just 6.2%.

- Amdahl revenues leaped 68.3% in 1983 to $777 million. Profits increased nearly seven fold to $46 million, but Wall Street continues to be unimpressed. National Advanced Systems also had a record year, but parent National Semi does not break out its financials.

Migration patterns

1984 is the first real test of how important field upgrades really will be to the IBM high-end customer base. Early results from IDC's annual migration study suggest considerable churning of the 30XX base in 1984, with 34% of a sample of 280 30XX users planning to change their 30XX class system.

Broken down by specific processor line: a full 30% of the 3083 users surveyed expected to move to another system in 1984, compared to 19% of the 3081 users and 42% of the 303X crowd. Given the considerable 3083 upgrade activity, it is indeed possible that the 18% increase in 308X engines will result in less than an 18% increase in processor revenues.

EDP/IR thinks that 3084 shipments may be the area most directly affected by the new announcements. Users with a 3081K now have to decide whether to make the upgrade to the 3084 or to buy the new 3081 KX, hedging their bets in case that machine contains more than is now apparent. Curiously, the new 3084 QX can be shipped intact from the factory, while the old 3084Q is still only available as an upgrade.

The push for /XA

IBM continues to make it clear that it wants its customers to move to MVS/XA as soon as possible. In its latest batch of technical letters, it notes that over 600 licenses have been sold so far and that the number of valid APARS is 50% less than expected and 50% less than those received during the move to MVS SP 1.3. User experiences have generally confirmed this but many have complained of poor /XA performance, and some are even holding back on full /XA implementation until IBM improves the performance situation.

Additionally, IBM has said that it will provide no further functional enhancements to OS/VS1, and that high growth DOS/VSE users considering MVS should probably go right to MVS/XA. IBM has come up with a couple of little perks to help ease the DOS-to-MVS pain. It is offering a six month waiver on software fees beyond the two month testing and evaluation purposes.

PCM response

Neither Amdahl and National Advanced Systems are overly concerned with the new announcements, since both had been expecting some sort of price cut or performance boost. At press time the two companies were still preparing their responses, which will appear in the next issue of EDP/IR. Both companies also confirmed that they still plan to meet their /XA delivery date of April 1.

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SNA CONTINUES TO EVOLVE TO MEET EMERGING COMMUNICATIONS REQUIREMENTS

Ten years ago, the IBM data communications world was in turmoil. Terminals were dedicated to their applications and access methods were proliferating -- TSO used Tcam, while CICS and IMS used Btam. Bisynch was not layered and was largely device dependent. It was up to SNA and Vtam to stem the rising chaos.

In 1984, the datacom world is still in turmoil. Documents created on one system can't be used on another; network expansion can't keep up with demand, and a host-orientation forces needless overhead. Once again, SNA, this time with Disoss, Snads, DCA/DIA, and LU 6.2, is being asked to restore some order.

In the 1970s, IBM hammered out the lower levels of its layered SNA architecture. In the 1980s, the focus is shifting to application level services. These new higher level functions have become some of the giant's most strategic products and should become the industry's next set of de facto communications standards. Despite a history marred by DNA-like complexity, begrudging user acceptance, and a general failure of IBM to offer state of the art networking services, SNA has survived and is now installed at 57% of IBM's 30XX sites.

Current additions to SNA reflect the thinking of the "new IBM." IBM is now referring to SNA as a "distributed operating system," and is learning to respect peer-to-peer needs within SNA's hierarchical structure. Additionally, IBM's publication of document content and interchange architectures (DCA/DIA) is a clear signal that IBM is preparing to deal with a world of multi-vendor SNA networks. Among some of the key developments in SNA:

- Peer-to-peer links. IBM's Advanced Program-To-Program Communications (APPC) facility (as implemented in Logical Unit 6.2) is a general purpose inter-program protocol that allows for application-to-application links. Expect LU 6.2 support for many products in 1984.

- SNADS. With SNA Distribution Services, IBM recognizes that services such as electronic mail and file transfers are often done more efficiently in an asynchronous manner (but using SNA not ascii devices). Previously, SNA had only allowed synchronous data distribution.

- Gateways. In late 1983, IBM finally dealt with the embarrassing inability of one SNA network to talk to another. By using gateways, IBM preserves the autonomy of individual SNA networks.

- VM support. Last September IBM promised SNA support (ACF/Vtam) under VM without using a guest operating system such MVS or DOS.

- Disoss use. IBM's Disoss is now installed at 12.2% of IBM 30XX and 43XX systems. As with SNA, the 30XX people are moving most quickly.

- PC impact. Along with 3270s, PCs are IBM's most pressing SNA LAN need. The PC complicates life under SNA because it must at different times look like three different logical devices -- LU1, LU2 and LU6.

- LANs. It appears that IBM will go with two local nets. A token passing system for large SNA customers, and the Sytek-designed CSMA/CD system for use with PCs from IBM and others.

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SNA today

For a long time SNA's shortcomings -- overhead, complexity, host-orientation, satellite support, etc. -- were masked by a general lack of alternatives, but IBM can't be quite as confident as it used to be about its customers' networking loyalty. At the very high end, major IBM customers such as Citibank, Bank of America and a couple of dozen others are evaluating and installing private packet network technology as an alternative to leased SNA lines. SNA's weakness in high volume transaction processing and its slow response times for remote terminals have even forced some users to reconsider link level protocols and IBM's ACP, in a potential return to yesteryear.

On the local level, the expression "had it with coax" hits home with many large shops. The inability to quickly add and move devices, and the time, expense, and confusion involved in pulling cables has spurred interest in large-scale local area network projects. Pending a real LAN, IBM's 3299 coax multiplexor provided a short term answer for some of these cabling problems.

Distributed, multi-vendor computing is another major force. A host orientation results in needless communications overhead and inefficient routing once one moves into a world of distributed intelligence. At the same time, IBM now knows that it alone can't meet all of its customer's hardware needs, and thus many of these distributed systems will have to consist of non-IBM equipment.

Snads ... the latest pieces of the puzzle

Recently, IBM's DCA/DIA specifications have received lots of publicity as the vendor community starts to realize that it is possible to move beyond the lower link levels of SNA up into application-level services. Vendors who once complained about the need to support IBM standards are now eagerly awaiting published specifications especially in the areas of voice, image and graphics. IBM may even offer an SNA certification plan, like Tymnet and Telenet do for X.25, and three years hence DCA/DIA support will be like SNA support is today.

Getting less attention has been IBM's SNA Distribution Services (Snads) and its Advanced Program-to-Program Communications (APPC). But IBM has made it clear that along with Disoss, these two services will be vital to DCA/DIA products, as well as IBM's new focus on delayed delivery and peer-to-peer communications. In the words of the IBM System Journal (V/22, #3, 1983):

> *"Along with the advent of office systems and other distributed applications has come the requirement to provide a common architecture for interchanging data asynchronously among diverse systems and products. SNA Distribution Services (Snads) provides a general asynchronous (delayed delivery) data distribution facility for SNA applications. The initial implementations are for office systems applications."*

Asynchronous transmissions can greatly reduce communications overhead in heavy messaging and other store and forward environments. Services such as electronic mail are particularly well suited to asynchronous traffic. When IBM says "asynchronous," it does not mean ascii. Snads requires SNA devices.

As is its habit, IBM has invented lots of complex terms for Snads, which most vendors would simply call an intelligent file transfer protocol, and as is the case with SNA, Snads is not a product that one buys, it's an architecture

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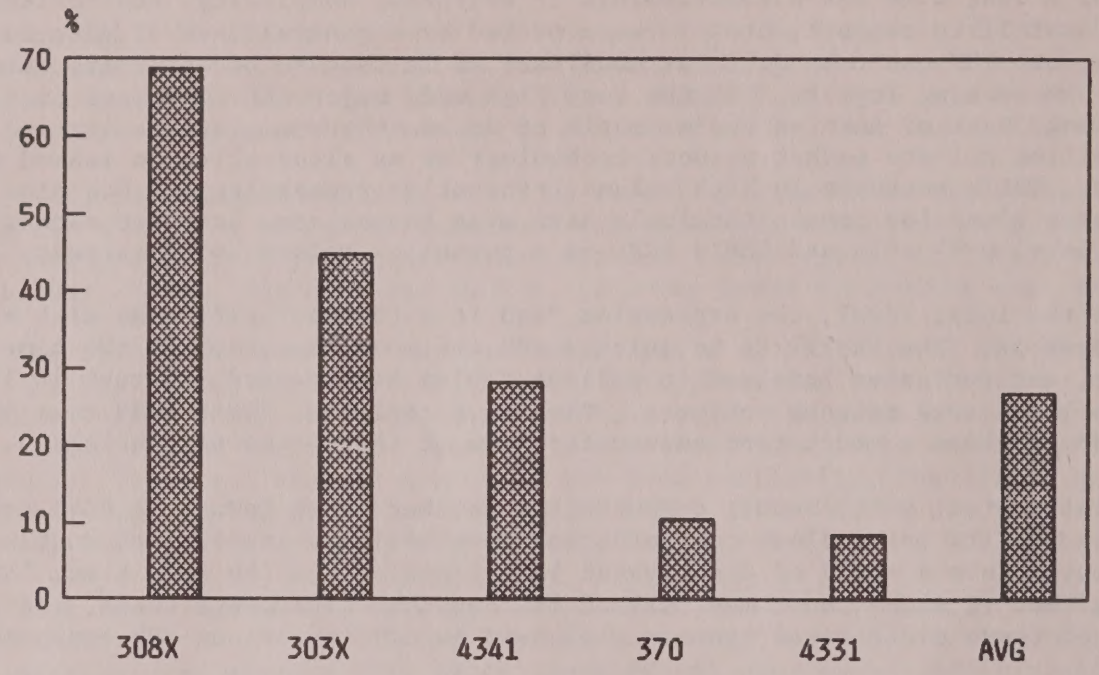
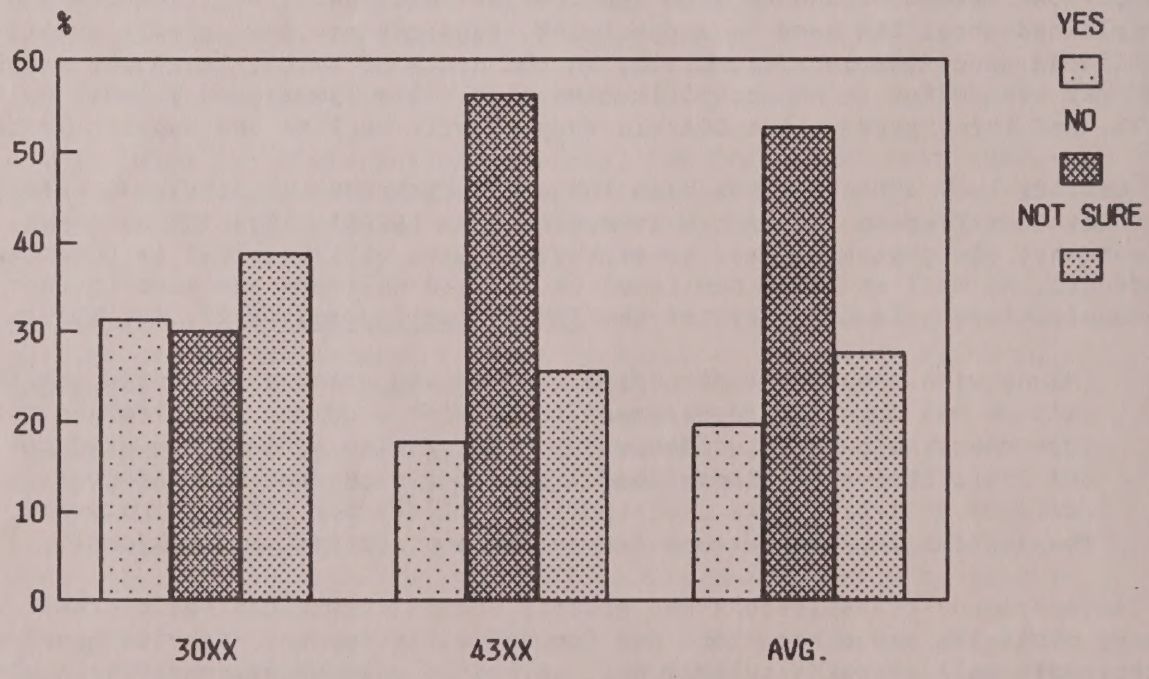
PERCENT OF IBM U.S. SITES RUNNING SNA, BASED ON SURVEY DATA AS OF 12/83
(Copyright 1984 -- International Data Corporation)



PERCENT OF THOSE SITES WITHOUT SNA THAT PLAN TO
IMPLEMENT IT OVER NEXT 12 MONTHS
(Copyright 1984 -- International Data Corporation)



Notes: Figures for both charts above are based on a year-end 1983 survey of more than 1,000 IBM mainframe sites. This is one of the largest SNA samples IDC has ever had. The distribution of 43XX vs. 30XX in the sample closely resembles real world populations.

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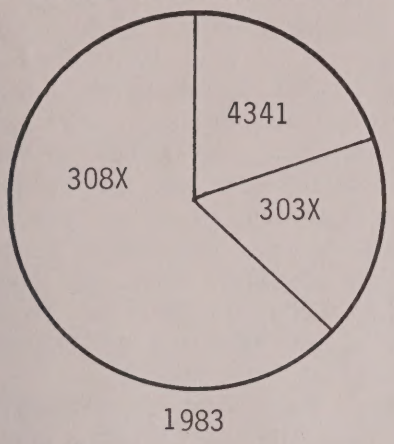
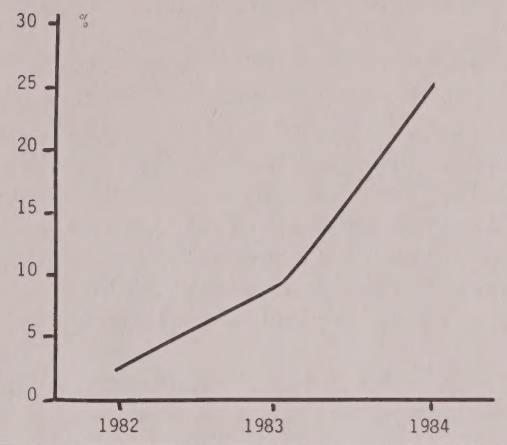
U.S. DISOSS INSTALLATIONS -- 1983



DISOSS USE AND PLANS, 1982-84



and set of specifications that one follows. The initial implementation is via Disoss Release 3.2 and 5520 Release 5.

Thus, IBM's advanced datacom products are still limited to the relatively mundane world of the 8100, the 5520, the Scanmaster, and the Displaywriter. This helps explain why Disoss has been a slow seller, despite a strong push from the IBM sales force, which is telling customers to feather their nests for the future. Disoss support on the PC and S/36 should give a needed boost.

Advanced Program-to-Program Communications (APPC) in SNA

Just as multiprogramming CPUs led to shared data bases and utility software, the emergence of multi-function networks is making it desirable to get away from application-specific datacom links by building durable interfaces and general purpose utilities for resource sharing. Again, the IBM Systems Journal:

> *"The development and wide use of network utilities, the advent of intelligent workstations and small processors dependent on servers, and distributed applications, in general, require a set of architecturally defined interprogram primitives as a foundation."*

IBM's APPC protocol (as implemented in Release LU 6.2) is the first layer of this foundation, and it is the key to future higher level services between IBM and even non-IBM gear. The idea is to build a single protocol rather than a unique interface between every pair of products. In the words of IBM, LU 6 "is the base on which the IBM distributed operating system is evolving." It is also the basis of future peer-to-peer offerings.

This does not, of course, mean that networking hierarchies are out. But over time things like routing tables, directory services, and store-and-forward capabilities will evolve into distributed data base systems, a la Tandem. To some extent they already have, but functions such as Snads and APPC have been designed not to rely on any single host or SSCP.

Thus, SNA is changing to meet new market needs. But as IBM piles on the acronyms, remember that IBM doesn't change SNA for sport. The internal cost for issuing a new release for something like VTAM is very high, often much more than IBM could get back by using SNA as a competitive weapon. Ever-deepening system complexity is, unfortunately, the basic nature of the datacom beast.

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• IBM OFFERS 8 MHz 68000-BASED XENIX SYSTEM. The industry has known for some time that IBM Instrument's System 9000 would eventually support Microsoft's Xenix operating system. But what has surprised many is that the system is being made available through the regular IBM national accounts, national marketing and VAR sales forces in addition to IBM Instruments. As such this system will, at least temporarily, fill IBM's need for a small multi-user system to compete with Altos and many others. Whether it is a key part of IBM's Unix and small system strategy remains to be seen. The system supports up to four users and can have up to 1MB main memory. Configured systems start at $16,000.

• NCR USES TOWER TO REPLACE 9000 LINE. Count NCR as the first of the mainframe companies to use a merchant component based supermicro to replace an existing low end product. NCR will use its current 68000-based Tower product to replace its successful (over 20,000 systems) but aged 8200/9020 lines. The old Tower continues as a Unix system; the new Tower (called I-tower) focuses on RM/Cobol. NCR feels that it can ride up the Motorola processor curve without cutting into the sales of systems based on its own 32-bit chip which it says is considerably more powerful and expensive. List price for a standard I-Tower configuration is $29,000. Shipments begin in March.

• PICK ACTION STIRS. After years of letting a good system languish, Dick Pick is finally getting his Pick operating system out into the mainstream. Pick Systems recently announced that Pick would be available on the IBM XT in a multi-user environment with powerful DBMS capabilities. Pick is already available on the S/1 and 4300, and thus if successful on the PC XT it could prove an important bridge into the larger IBM world. Its latest release, Pick Release 84, is said to represent a true open architecture. Pick Systems estimates that there are about 250,000 experienced Pick users. Pertec and Altos have just announced new Pick-based systems.

• ELXSI CONTINUES TO ATTRACT INTEREST. NASA is the latest to sign up for Elxsi's System 6400. By stringing together from one to ten processors, Elxsi says its system can grow incrementally from four to 40 MIPS without incurring significant overhead. Elxsi sees its system as bridging the gap between Vax and Cray systems. NASA will use the 6400 for analyzing flight data.

• DEC TO MARKET TELESOFT'S ADA COMPILER FOR VAX. Telesoft describes its Ada compiler as being "fully embedded in the VMS environment. The company hopes to submit its compiler for Department of Defense validation in the near future. DOD has recently designated its Language Control Facility at Wright-Patterson Air Force Base as its Ada validation service center. Currently its Ada work is based on a Rolm/Data General system built upon DG's MV/8000.

• CDC TO MARKET TANDEM-BASED EXPERT SYSTEM. With what it calls a "revolutionary medical information and diagnosis system," Control Data Corp. is entering the expert systems business. It has obtained exclusive rights to the University of Utah's HELP software which it will sell along with Tandem CPUs. The system is designed to be a total hospital system that can crosscheck data from all departments, incorporating 3,000 medical decision rules. One such system has already been installed.

• CENTRAL SERVICES ORGANIZATION RENAMED BELL COMMUNICATIONS RESEARCH.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR FEB. 16, 1984 ● V/19, NO.20 P.J. MCGOVERN, PUBLISHER

IDC INTERNATIONAL DATA CORPORATION

GRACE COMMISSION REPORT GIVES POOR MARKS TO FEDERAL COMPUTER USAGE, BUT RECOMMENDATIONS NOT CAUSING MUCH OF A STIR

At a time when the federal deficit is approaching $1,600 per U.S. worker, one might expect cost-cutting commissions to have more than their customary lack of clout. But thus far at least, the 23,000 page effort by the President's Private Sector Survey on Cost Control (headed by J. Peter Grace) seems destined for just another place on the bureaucratic shelf.

Two-hundred and thirteen of these pages dealt with Uncle Sam's use of computers, and the commission did not like what it saw. Not surprisingly, it concluded that much of the $12.2 billion to be spent on computer operations in 1984 (some 1.4% of the federal budget) will be wasted and that many computer systems are not handling the tasks they were designed for. Some key points:

- Hardware. The commission estimates that Federal Government computers have been installed for an average of 6.7 years, compared to about four years in the private sector. A staggering 50% of these systems are so old that they are no longer supported by their manufacturers.

- Software. The government continues to spend a larger share of its budget (48%) on software than the private sector. But the real problem is that failure to keep up with software improvements makes it difficult to move up to more modern hardware.

- Personnel. The combination of higher private sector salaries and outdated government hardware has limited the government's ability to hire and keep top-flight people.

- Procurement. The commission estimates that major government procurements take from 2.5 to 4.0 years compared to about 0.5 to 1.5 in the private sector. Some systems are obsolete before they are installed.

- Projected savings. The committee says its recommendations could save $21.8 billion over three years. But much greater savings would come if major departments took better advantage of computer capabilities.

- Compatibility. Hardware and software incompatibilities, even within agencies, are pervasive and well entrenched.

EDP Industry Report is published in annual volumes of twenty-four issues each by International Data Corporation, Post Office Box 955, Five Speen Street, Framingham, MA 01701. Entire contents © 1984 by International Data Corporation. **Editor,** David Moschella, **Director of Publications,** Molly Upton; **Census Editors,** Lloyd Cohen; **Contributing Editors,** Marcia Brooks, Aaron Goldberg, Jack Hart, Ann Morley, William F. Zachmann; **Circulation Manager,** Mary M. Trayte, Patrick J. McGovern, Chairman, International Data Group; Peter Rowell, President, International Data Corporation. Editorial ideas and information are researched and formulated by the editorial staff. Information and opinions in each issue are based on the best information available, but their accuracy and completeness cannot be guaranteed. **Subscriptions:** One year $365, two years, $645. Single copies priced as indicated on inside pages. Prices for multiple copies on request. Reproduction without written permission is completely forbidden. Telex 95-1168. Telephone **617/872-8200.**

SELECTED PASSAGES FROM THE GRACE COMMISSION REPORT

• Procurement. "Although a multitude of directives, regulations, circulars, guidelines, and policies exist which affect the acquisition process, no single readable, understandable document is available which can be used across the Federal Government for ADP/OA procurement guidance."

• Record keeping. "The cost of the Army's business-type automation is estimated at $1.5 billion. This estimate is rough because the Army does not know how much it spends on ADP/OA. Neither does it know what kinds and numbers of computers it has, where they are located, or whether they should be replaced."

• Timesharing. The Department of Transportation spends "$18 million for commercial timesharing services, even though 53% of the TCC (Transportation Computer Center) prime time and 80% of TCC non-prime time computer capacity are not being used."

• Operating systems. "This is a major problem. ... There are approximately 1,000 different OS environments now being maintained government-wide.

• Applications software. "The GAO found that there are over 350 different accounting systems within the federal government."... It is unfortunate that there is, at present, no central inventory describing the numbers and attributes of software application systems."

• Obsolescence. "A recent joint report by OMB, GSA, and the Department of Commerce entitled A five year plan, meeting the ADP and telecommunications needs of the federal government indicated that the government has plans to replace 1024 CPUS over the next five years. Assuming this ... the average age of CPUs will worsen to 10.1 years."

• Personnel. "At the upper levels the picture is bleak. Most of the talented ADP specialists who came to government in the mid-sixties have left. The major reasons cited are declining work environment (obsolete hardware, decreasing quality of available staff) and non-competitive salaries. The 1982 alternative plan was the fifth consecutive year in which federal salary increases have been lower than required to maintain comparability with the private sector, and the lag of federal pay behind the private sector has become large, almost 14% averaged across levels, and more than 25% at the upper grades, according to the advisory committee on federal pay."

• Waste. "Processing HCFA business necessitates rewriting 99 reels of magnetic tape nightly. Approximately 30% of the tape reels do not have labels that enable the computer to check if the proper tape is being used. ... This results in an error prone situation with an unacceptable level of job failures. As an example, approximately 50% of all work performed by the SSA (Social Security Administration) data center fails for some reason and requires a rerun."

• Databases. "About 20% of all (tax) returns were still not entered into the (IRS) system for 1978. The data which are entered are not put to maximal use because of the design of the master files. These files are used for historical matching and are potentially the key to more effective use of ADP technology. Unfortunately, the master file design was established in the 1960s and predates modern data base concepts such as random access, on-line storage, and integrated data bases accessible by high level languages."

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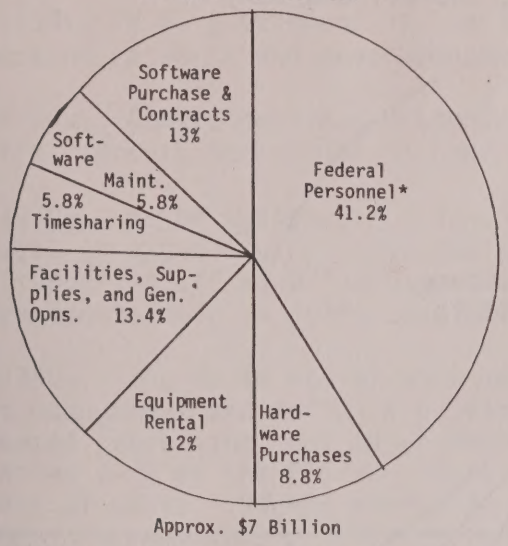
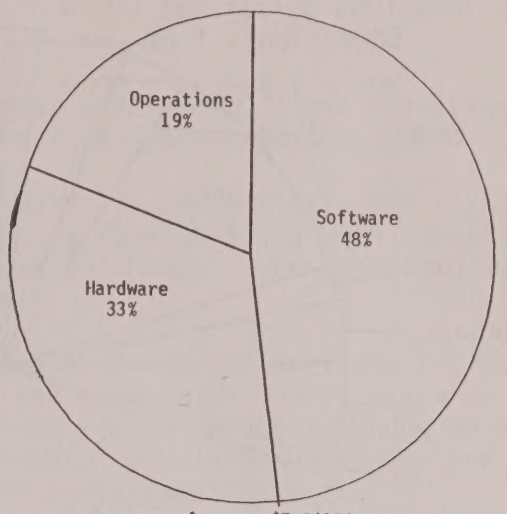
SEGMENTATION OF FEDERAL GOVERNMENT GENERAL PURPOSE ADP SPENDING*

RESOURCE DISTRIBUTION



Approx. $7 Billion

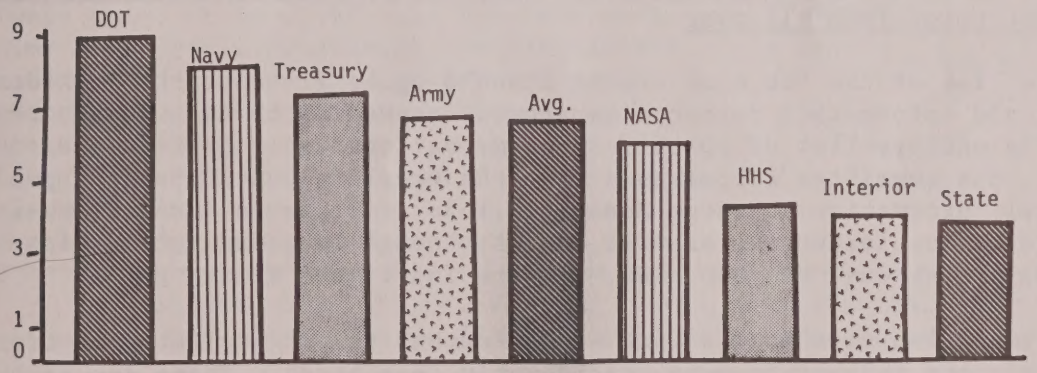
FUNCTIONAL DISTRIBUTION



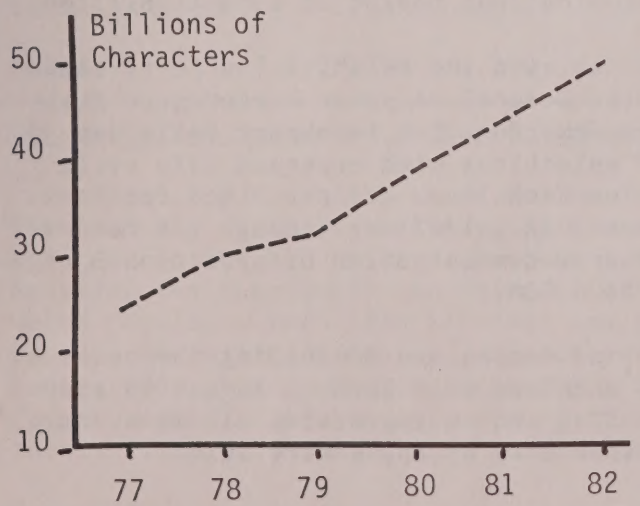
Approx. $7 Billion

*Note General purpose spending excludes special purpose systems common in the military. For comparisons to the private sector, see EDP/IR, Vol. 19 No. 1.

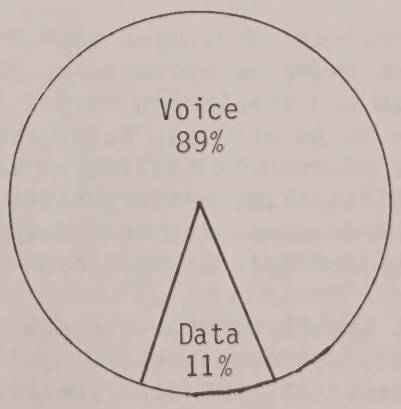
AVERAGE AGE OF GOVERNMENT GENERAL PURPOSE COMPUTERS, 1981
(Source: GSA)



FEDERAL DATA COMMUNICATIONS TRAFFIC



FEDERAL TELECOMMUNICATIONS SPENDING



$6 Billion

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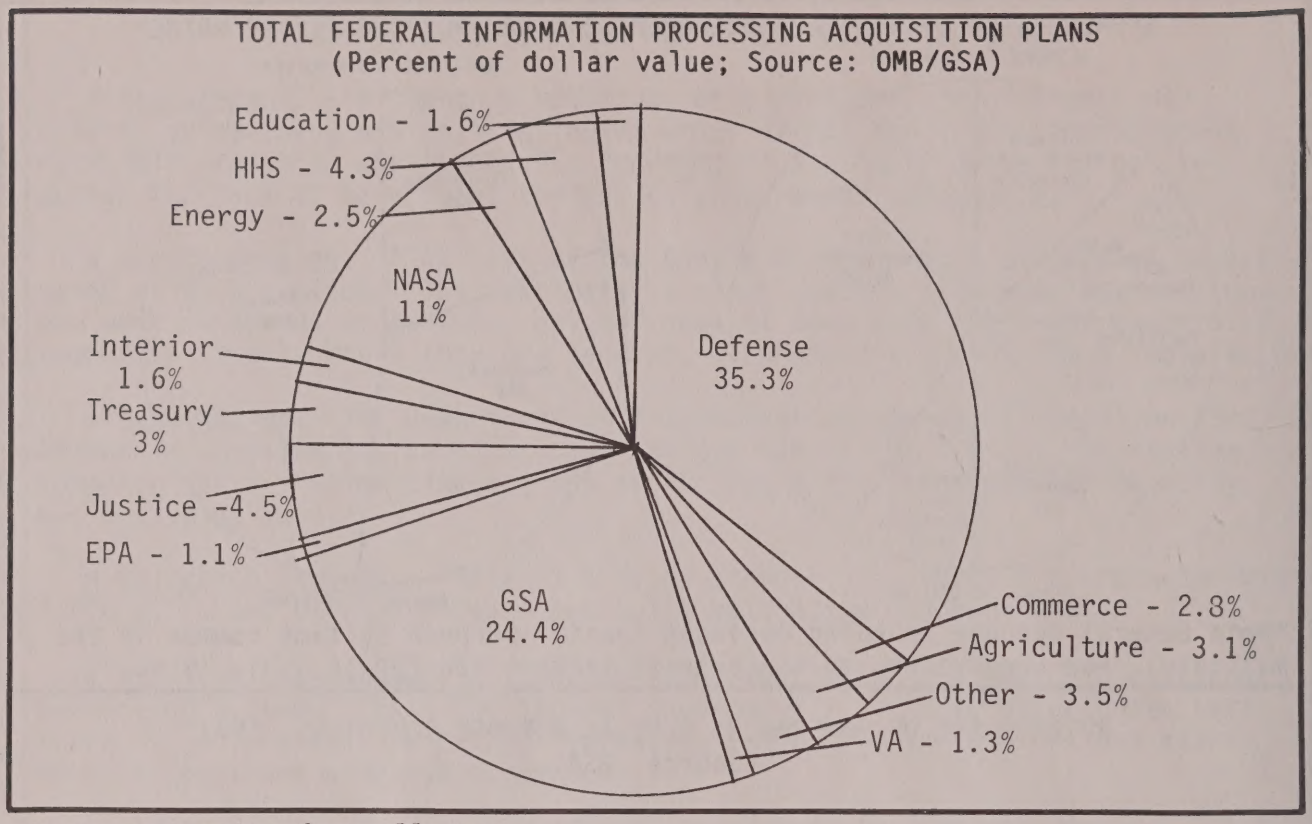

Government notes from all over

On the list of the ten most urgent trouble spots given to the President, ADP spending and information resource management ranked fifth and sixth. Besides the nearly endless list of specific recommendations (some quite vague and arbitrary), the committee recommended that the President establish the position of Federal Information Resource Manager. This position is designed to increase executive office leadership as well as cut through the conflicting lines of responsibility between OMB, GAO, GSA, and the individual agency heads.

The commission also took a look at government telecommunications efforts. In general, its judgements were considerably less harsh. There are accounting problems and poor charge-back systems, and 30% of the data transmission is in the 300 to 1,200 baud range. But the only source of substantial savings identified by the commission was that telecommunications system sharing could yield savings of up to 20% on a 1983 data communications budget of some $1 billion.

Numerous government task forces have hit upon the relative ineffectiveness of benchmarking operations. Recently, the Federal Computer Performance Evaluation and Simulation Center (FEDSIM) recommended that benchmark tests continue to be used in "fully competitive" selections with contract life cycle costs of over $2 million. Other selection techniques are permitted for "compatibility limited" acquisitions. Current GSA guidelines (though not mandatory) recommend either a benchmark test or a demonstration of operational capability for systems that cost more than $300,000.

On the PC front, it appears that IBM and Compaq are dominating the sales at the new GSA computer store. Of the 300 machines sold between August 16 and September 30, 135 were IBM PCs, 39 were XTs, and an impressive 118 were Compaqs. During that period only six machines made by Apple were sold.

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BRIEF HISTORY OF THE FEDERAL GOVERNMENT'S USE OF COMPUTERS

1950s. U.S. government is the leader in early tabulating equipment and computing research and development.

1960s. Comprehensive and complex systems developed. Large operating staffs. Brooks Act passed to control perceived procurement chaos.

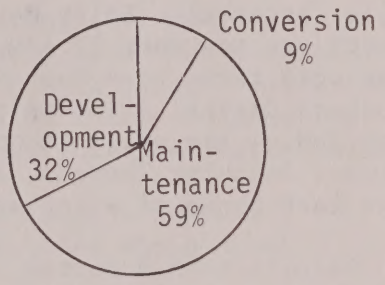
1970s. Major systems in place. Some gains in productivity but rapid increases in expenditures. Routine maintenance expands along with operations and support staff as private sector systems catch up. Incremental software improvements made to aging base of hardware.

1980s. Increased use of more advanced private sector services for facilities management and software development and conversion. Acceptance of distributed processing, but major 1960s systems remain in place except in small agencies such as the FBI and State Department. Obsolete systems become major source of waste. Micros emerge as another procurement headache.

A push for more outside contracting

As federal data processing systems fall behind those of the private sector, the case for outside contracting services becomes stronger. Although comparing private and federal costs is not always easy, it is clear that in areas such as claims and payroll processing, private sector rates are often far less than government expenses. Companies such as Computer Sciences and Electronic Data Systems are well positioned for these developments. International Data Corporation estimates for the facilities management and contract programming markets are given below.

1981 FEDERAL SOFTWARE EXPENSES



$2.9 Billion

PROFESSIONAL SERVICES REVENUES BY TARGET MARKETS, 1982-1987
(Copyright 1984 -- International Data Corporation)

	Government			Commercial			International		
Service type ($M)	1982	1987	%	1982	1987	%	1982	1987	%
Contract Prog.	1,675	3,755	17%	780	1,900	19%	430	1,155	22%
Facilities Mgmt.	415	650	9	560	900	10	110	360	27
Total	2,090	3,755	12	1,340	2,800	16	540	1,515	23

GAO calls for increased software testing

Considering the billions of dollars spent on software, it is not surprising that not all of it is sufficiently tested. A recent GAO survey of eight Federal agencies and 207 DP installations found that 73% of the data centers do not document their software according to National Bureau of Standards guidelines which require a test plan and test analysis report. GAO also concluded that the use of testing tools was inadequate with only 13% of the sites using such tools. GAO cites private studies that show that correcting mistakes in existing programs is seven times more expensive than corrections during testing, and thirty times more costly than corrections made in the design stage.

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ADA MARKET BEGINS TO EMERGE, BUT FUTURE STILL SHROUDED IN QUESTIONS

The history of Ada is well known. Facing excessive use of assembly language, heavy real time processing needs, and almost total machine dependence, in 1975 the Department of Defense, the world's largest software user, set out to develop a portable, high level language for its mission-critical systems, hoping to save an estimated $1 billion per year in software costs.

From the outset it was known that forcing new software onto a diverse group of users in a rapidly changing marketplace would be difficult, and nine years later the issue is still up for grabs. But Ada is now an ANSI standard, and is required for new DOD "mission critical" systems. Additionally, several large Ada contracts have already been awarded.

Clearly, knowledge of the complex Ada language is valued in the marketplace. According to the newsletter Adadata, Ada experience adds about 20% to a programmer's salary. Advertisements for Ada programmers have been on the rise, and Ada training and educational work is underway within and outside of DOD.

Ada has also succeeded in generating significant, but not overwhelming, supplier interest. Edith Martin, Deputy Secretary of Defense, estimates that there are now some 25 Ada compiler efforts in the U.S., Europe and Japan. Thus far only three have been validated -- those from NYU, Data General/Rolm, and Western Digital. Two major Ada efforts -- Softech for the Vax and Intermetrics for IBM -- are still incomplete. Key venture capital Ada firms include Intellimac, Computer Thought, Alsys Microsystems, and Telesoft (working with DEC), the last three of which are concentrating mostly on Ada workstations.

Despite this momentum, significant barriers remain. While observers agree on Ada's strength as a coding language, over the last year or so it has become clear that development is far from complete. Areas such as prototyping, system integration, testing, and maintenance have not received sufficient attention. DOD's STARS program (Software Technology for Adaptable, Reliable Systems) is expected to address these software life cycle issues.

But perhaps more importantly, the pace of software development in the outside world still threatens Ada's value. While committees haggle over Ada specs, DOD has been making increasing use of both Prolog and Lisp for many advanced applications. The clear value of these efforts has already forced DOD to come out with an exception edict concerning Ada and so-called "problem-oriented" languages, but DOD does not see these as threats to an Ada standard.

The world is changing in other ways as well. For both improved packaging and reliability, over the next few years, it is expected that there will be a sharp increase in the use of firmware programming in defense systems. At the same time, there is increasing government-wide pressure to make use of packaged application software in general purpose systems. Neither of these trends is likely to take advantage of Ada's design attributes.

Finally, Ada won't become dominant unless DOD maintains unwavering support. Rumors persist that within DOD there remains considerable opposition to Ada, and there are unsubstantiated reports that Congressional Appropriation Committee members have been briefed on proposals to reassess current software strategies. 1984 will be the first real test of the strength DOD's commitment.

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COMPUTER MATCHING PROGRAMS ON THE RISE; EARLY RESULTS SHOW PROMISE

Given today's intolerable deficits, both the public and the Congress are willing to approve almost anything that promises to either catch fraud or cut out waste. This has led to an environment ripe for experiments in computer matching, an area once thought to be too politically sensitive.

Despite the inevitable references to Big Brother, thus far at least matching has been most prevalent at the state level. The Senate Government Management Oversight Subcommittee has estimated that there are some 170 state programs compared to about 85 at the federal level. The largest federal user by far has been the Department of Health and Human Services which is believed to have a hand in 75% of all federal matching efforts.

Applications have included unpaid parking tickets, student loans, and child support as well as tax and draft evaders. Most of the projects have proven cost effective, and would be more so if government data bases were more up to date and flexible. Having reviewed many matching applications, EDP/IR could not find any whose outcome wasn't to catch someone doing something illegal.

The privacy debate rages over three main issues: using government data for purposes unknown to the individual information providers; use (and purchase) of privately collected data; and the worry that if matching becomes pervasive, people will fear the collection process and hold back data from both government and private concerns. Examples of the three situations are listed below:

- The Selective Service began in 1982 to match its records against Social Security files for names and addresses of those who had not registered for the draft.

- The IRS plans to buy commercially available lists of residents of affluent areas to try to catch tax cheats.

- There is much controversy over whether census data should be used, since such use might cause many to not fill out the census forms.

The OMB has recently published a checklist (M-84-6) for federal use of matching techniques. These projects are not approved without an awful lot of paperwork, and there is considerable time lag. Nonetheless, critics think that the process is largely a rubber-stamp effort, with few projects being shot down. The key points of the approval process are summarized below:

- Identify sources of data and determine which files are protected by Privacy Act and OMB Circular A-108.
- Do cost/benefit analysis and compare to manual matching procedures.
- Define data handling procedures to avoid unauthorized use.
- Define validation steps to prevent harassment caused by bad data.
- Obtain written agreements from all source data agencies or firms.
- Submit all finalized matching plans to the Federal Register for publication at least 30 days before match begins. (This is the public comment period.) Send same report to both houses of Congress.
- Set up security procedures for protecting matching "hit lists."
- Institute a tracking system that monitors project performance, including error rates, people affected, and cost/benefit data.

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• STC DROPS CMOS MAINFRAME. Storage Technology just couldn't get its Cmos 4300-class IBM machine to market in time to enjoy any type of price/performance edge. With Magnuson crippled and IPL hurting, the 4300 market is virtually all IBM's, except for NAS's 4381-size machines. For STC this is the second time within the last two years it has had to give up on a major project. The other was its Virtual Storage System, a back end data machine whose technology has just been sold to some former STC employees. With this failure and its 3380 disk troubles, STC growth opportunities seem closely tied to its optical disk products, a market still in the pioneer stage. Adding to STC's problems, a group of investors is suing STC for fraud, claiming that the company misrepresented the project's condition while trying to raise investor funds.

• HP OFFERS SATELLITE LINK. Joining Wang, Tandem and Electronic Data Systems, Hewlett-Packard sees an opportunity in teaming with a satellite service vendor to offer end to end telecommunications services that bypass the telephone network. Vitalink is supplying the earth stations and the traffic will be carried Western Union's Westar IV. HP claims a dramatic price difference between its service and terrestrial microwave systems.

• IBM INTRODUCES FOURTH ROBOTICS SYSTEM. Designed for electromechanical assembly, fabrication, and material handling tasks, the new 7545 robotics system is an extended version of the 7535. Like the others, it is programmed with IBM AML through the IBM PC. The 7545 costs $36,000 with deliveries scheduled for the first quarter of 1984.

• AT&T GETS INTO TENANT SERVICES BUSINESS. AT&T has signed an agreement in principle to work with Building Systems Co., a subsidiary of United Technologies, to provide data processing, telecommunications, and building management services to owners of multi-tenant commercial buildings. AT&T also has a teleconferencing venture with United Technologies. Tenant services have become a hot area, as vendors see the scale economies of shared facilities. SBS has also teamed up with a building firm in this market. AT&T is also known to be talking about acquiring an interest in Inmos, the U.K. semiconductor maker.

• VISI/ON PRICES SLASHED 80%. In an all-out battle for market share, Visicorp has cut the price of its window management software from $495 to $95. The move is aimed at Microsoft's Windows which still isn't being shipped.

• BURROUGHS ACQUIRES GRAFTEK. In order to strengthen its manufacturing systems offerings, Burroughs has acquired Graftek, a privately held CAD/CAM systems maker in Boulder, CO. Graftek specializes in mechanical design and drafting systems. It's software runs on a number of different vendor's hardware and can be used under Unix. Its two best known products are the Meteor, a full-color workstation and Comet, a 32-bit design system. The new company will be called Graftek - A Burroughs Company. No terms of the deal have been announced.

• HONEYWELL TO USE NCR 32-BIT CHIP. Honeywell will use the microprocessor in future computer systems and the two companies will jointly develop custom ICs to go with it. The move should help Honeywell bring 32-bit technology to its small scale systems. NCR hopes that its chip will become one of the industry's standard 32-bit MPUs. This is its first major OEM MPU deal.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR JAN. 30, 1984 ● V/19, NO.19 P.J. MCGOVERN, PUBLISHER

IDC INTERNATIONAL DATA CORPORATION

APPLE STANDS AS MAJOR ALTERNATIVE TO MS/DOS SYSTEMS; MACINTOSH GRABS LEAD IN TECHNOLOGY RACE

Over the last year, just about every micro vendor in the industry has tipped its hat to IBM and tied its future to the perceived standard of MS/DOS. Were it not for Apple Computer, a period of relative stability and incremental product refinement might well be upon us for at least the next 12 months.

But because Apple has refused to bend with the prevailing winds, the micro industry is about to witness the largest of its many marketing wars. Apple and IBM are now eyeball-to-eyeball with the Apple IIe squared off against the IBM PC jr.; Macintosh vs. the PC; and Lisa vs. the XT.

The battle goes far beyond product specifications. The companies have created two different cultural mindsets, and when trying to guess who will buy Apple and who will buy IBM, splits such as tastes in music or positions on Grenada might be as useful as analyses of software requirements. But Macintosh is the only product around impressive enough to challenge today's pervasive "IBM, of course" smugness. Some key points about Mac and its impact:

- Apple expectations. In its exhaustive press materials, Apple hinted that it expects to ship around 250,000 Macs in 1984, but it noted that Mac has been "designed from the start to be produced in the millions." If Mac doesn't sell, Apple will become a minor PC player.

- Markets. Apple says that it expects about 70% of its production to go to the business market; 20% to universities (at a 60% discount that has riled some dealers), and 10% to the home.

- Standards. There soon may be three "standards" -- MS/DOS, Mac, and a rumored proprietary system from IBM that might leave some of its PCM competitors out in the cold. It's been only about two years since CP/M was considered the de facto standard.

- Distribution. Apple expects 85% of the Macs to go through its dealer network, about 15% direct.

- Affect on Lisa. Lisa continues to be unbundled and can now be had without a hard disk. Lisa will run Mac software, but not vice versa.

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TOP TEN BUSINESS/PROFESSIONAL PC MAKERS 1982-1983, U.S. UNIT SHIPMENTS
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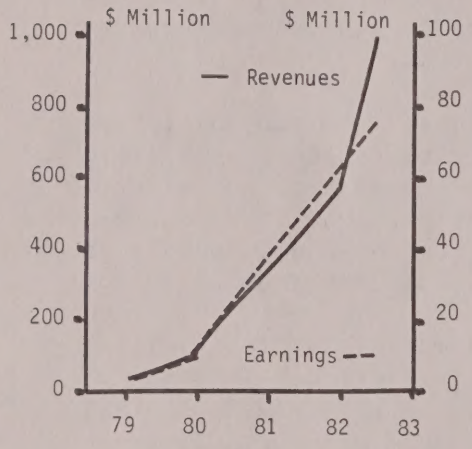
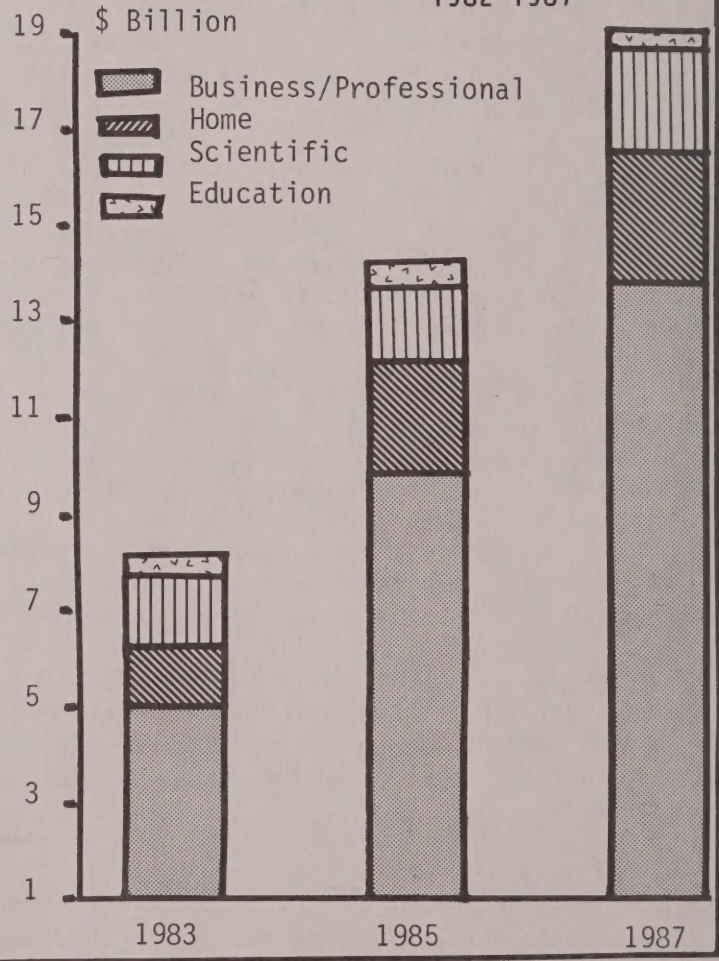
	1982	% Share	1983*	% Share*
1.	IBM	15.5%	IBM	20.0%
2.	Commodore	14.3%	Apple	9.5%
3.	Apple	12.5%	Commodore	7.3%
4.	Tandy	8.6%	Kaypro	3.7%
5.	Osborne	8.1%	Convergent	3.2%
6.	Convergent	2.2%	Digital	2.8%
7.	Sanyo	2.0%	Epson	2.7%
8.	Hewlett-Packard	1.9%	Compaq	2.3%
9.	NEC	1.9%	Osborne	2.1%
10.	Televideo	1.7%	NEC	1.9%
Top ten's share		68.7%		57.4%

*1983 figures are preliminary IDC estimates.

APPLE FINANCIAL PERFORMANCE
1979-1983



VALUE OF U.S. PC SHIPMENTS
1982-1987



The business/professional market will continue to dominate the personal computer market for at least the next four years. IDC expects that this sector's share of the overall market will continue to rise -- from 66% in 1983 to 70% in 1983 to 72% in 1987. Apple sees its shipments being in proportion to this with 70% of Mac shipments expected to go to the business professional market.

IDC expects that some four million PCs will be shipped worldwide outside of the home. Given this, Apple's expectation of 250,000 to 350,000 units shipped in 1984 translates to a market share of between 6% and 8% of the overall market, not counting substantial IIe shipments, 100,000 in December. (With the arrival of Mac, most IIes will go to the home market.) If Lisa is ever going to sell (less than 20,000 to date), it will have to grab onto Mac's coattails.

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APPLE SQUARES OFF WITH IBM

Apple Model	Current Price*	Date First Installed	IBM Model	Date First Installed	Current Price*
IIe	$1,400	2Q/77	PC jr.	1Q/84	$1,300
Macintosh	$2,500	1Q/84	PC	3Q/81	$3,300
Lisa	$5,500	2Q/83	PC/XT	2Q/83	$5,500

*Prices are for base systems of roughly equivalent configuration.

Put it this way. If Macintosh can't break IBM's hold on the market, then what can? On packaging (just a 10"x10" footprint), price, power, and ease of use, Mac is the clear winner. IBM counters with its unmatched software base and the IBM name. It is also true that the PC market is an unending game of leapfrog, and significant price/performance advantages are rarely permanent.

Assessing the net impact of Mac is difficult. The swarm of MS/DOS PC vendors has already guaranteed that hardware advancements will proceed at a brisk pace, as vendors vie to stand out from the crowd. It is difficult to see how the arrival of Mac can significantly affect a process where vendors are already eagerly awaiting future chips and disks. The effect on pricing might be more significant, but unless Mac begins to sell in large volumes, IBM won't feel the need to cut prices, especially if it continues to be supply-bound.

The biggest effect has to be on the independent software community which now has to make some decisions. To avoid the disaster of the software-starved Lisa, Apple has had Mac in the developer's hands for months, and just about all the prominent software houses have pledged Mac support. But not much software is available yet and rapid delivery will be crucial if Apple is to convert its current wave of publicity into a rush of sales. Steve Jobs says Mac has about 100 days to prove itself to the software and user communities.

As for technology, Mac should boost the credibility of Sony's high performance, hard-shelled 3.5" drives, joining Hewlett-Packard among the major vendors. Mac's 128K maximum memory serves as a reminder that memory is still expensive -- $3,000/MB on the Lisa, compared to roughly $4,000-$8,000 on minis and $10,000 to $25,000 on most mainframes. Apple's 64K ROM, which handles the operating system and all screen handling, is a masterful bit of code-cramming.

BURROUGHS IS GETTING BACK ON ITS FEET, NEW PRODUCTS AND STRATEGIES START TO PAY OFF

In September of 1980, when former Treasury Secretary W. Michael Blumenthal took the reins at Burroughs, it was well understood that, like its automobile-building neighbors, the company was due for a major corporate overhaul. Profits had just fallen 73%, and the company was building a reputation for poor service and inefficient manufacturing.

The road back has been bumpy and slow, but the signs of progress are finally becoming visible. 1983 profits were up 67% to a respectable $197 million (still a long way from 1979's $305 million level), and perhaps more encouraging fourth quarter revenue was up a solid 17% over the same period in 1982. Further improvements are expected in 1984.

Mainframes have been a big part of the story. The company says that it sold 80 of its large-scale 7900 processors (at some $2.5 million apiece) in the six

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months ending in December. It adds that current production is booked until at least the third quarter, implying sales this year of well over 100 systems. As of the end of 1982, IDC estimates that Burroughs had only about 200 large-scale systems installed, so high-end growth appears to be substantial.

There is also the potential for increased mainframe sales across the entire Burroughs line. Analysis of IDC's yearend 1982 mainframe census data shows that only 41% of the systems in Burroughs' installed base are less than 5 years old, compared to 71% for IBM. If Burroughs can hang on to its installed base, the upgrade business looks good.

The company recently introduced three new mainframes, blandly dubbed the Burroughs A9 Models B, D, and F. The A9 systems, which compete across the IBM 4361 through 4381 range, effectively replace the Burroughs 6900 machines, and future "A series machines" will be announced this year to replace the 5900 line. The new systems offer about 25% better price/performance and up to four times the memory capacity (up to 24MB). Object code compatibility will be maintained between the two families.

All the A-series machines make use of Burroughs new Multiple Logic Path (MLP) architecture which the company claims is a step beyond traditional pipelining techniques. A Burroughs spokesman described the difference by saying that MLP has extensive "look ahead" features and can handle three instructions at a time, whereas a pipelined system merely breaks a single instruction into several operands for simultaneous processing.

The 7900 systems were really the first of the A-series, but marketing pressure to have a 7800 follow-on led the company to stick with the 7900 label. The new A-series machines, however, are Burroughs first to use ECL circuits. The 7900 still uses CTL, and both are air-cooled. Burroughs notes that it was using the "A series" code-name well before the emergence of Mr. T.

As for the company's 1900, 2900, 3900, and 4900 systems, they will be replaced by a different series. The smooth numbering of systems from 1900-7900 has always masked the fact that the large and small systems use two different operating systems. Although applications can be migrated across the line, the object code is different. This is a pattern Burroughs expects to continue.

When asked to compare its products to those of IBM, a Burroughs spokesman suggested three approaches. First, strict comparisons of CPU prices are not particularly meaningful; it's the broader "cost of ownership" that it pushes to potential customers. Burroughs claims that when one includes software, maintenance, and peripherals, its costs are the "finest in the world."

The second line of argument centers around coexistence. A typical large IBM shop might have a two-year application backlog. A Burroughs system specially designed for certain applications can help cut into this without competing directly with IBM. Burroughs claims that its fourth generation language called Link can speed up application development anywhere from two to twenty times. Link is now running at several hundred Burroughs sites, with the price proportional to the power of the CPU. On the new A series Link costs $149,000.

Like all of the Bunch companies, Burroughs is talking more and more about SNA support and living within the IBM environment. Burroughs, however, claims that its SNA approach is fundamentally different that that of say Honeywell or NCR, who, like most companies, talk to IBM hosts by emulating SNA terminals.

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BURROUGHS' SHARE OF DOLLAR VALUE OF WORLDWIDE MAINFRAME SHIPMENTS
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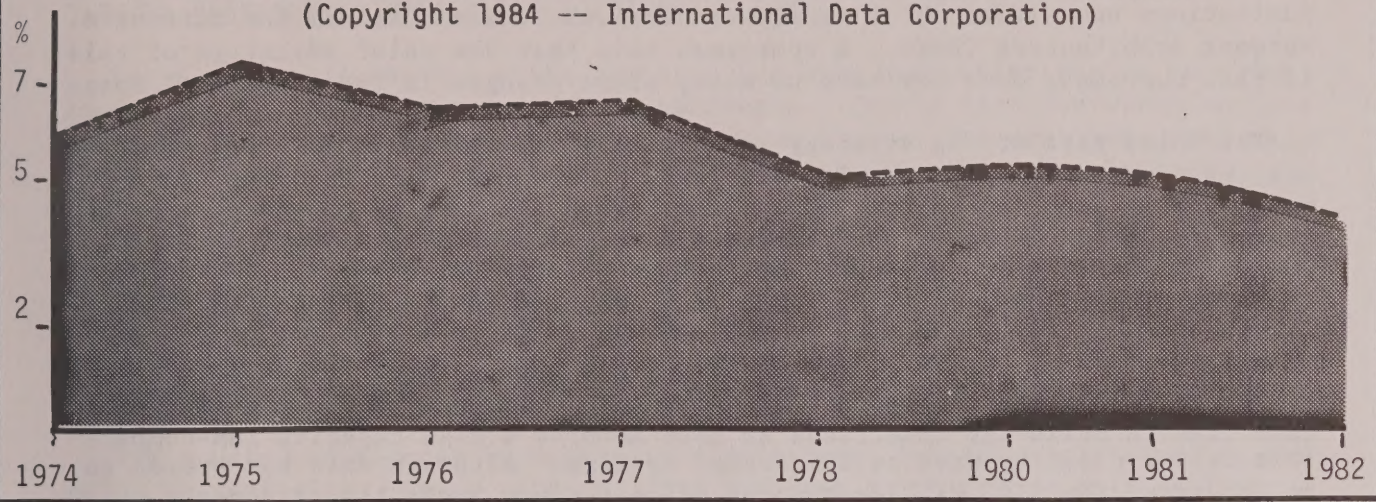
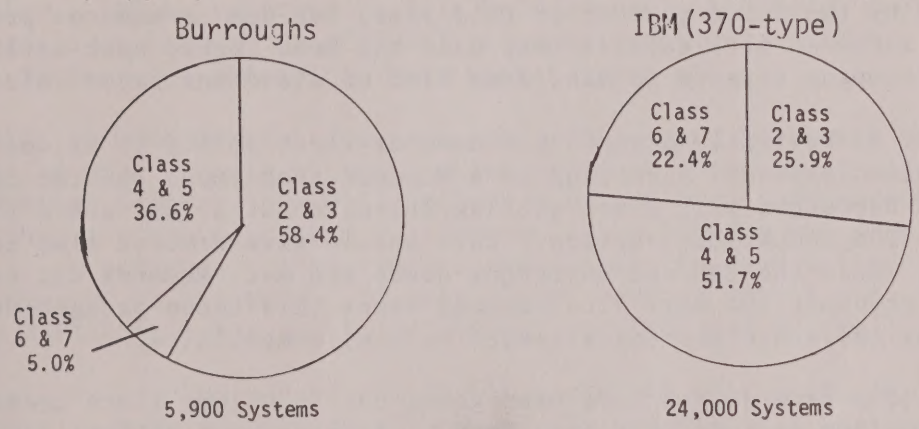
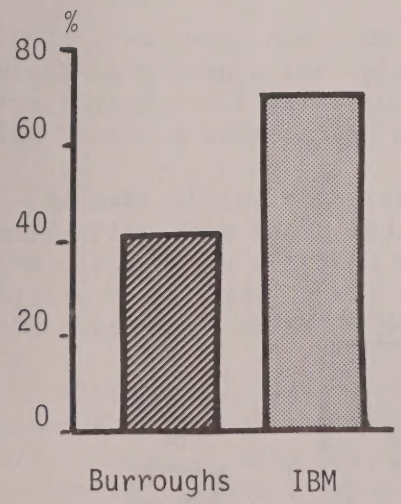


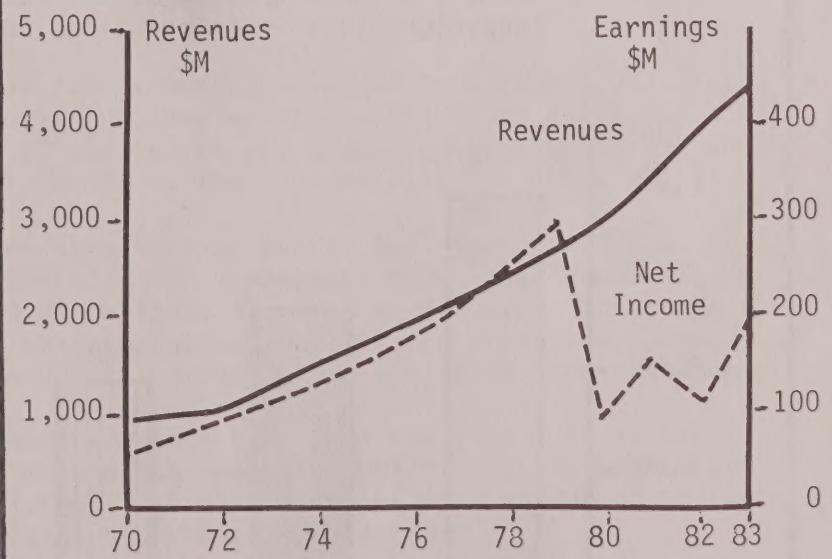
U.S. MAINFRAME INSTALLED BASE SIZE CLASS DISTRIBUTION, IBM vs. BURROUGHS
(Copyright 1984 -- International Data Corporation)



PERCENT OF U.S. INSTALLED MAINFRAMES LESS THAN 5 YEARS OLD AS OF 12/82



BURROUGHS FINANCIAL PERFORMANCE, 1970-83



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Burroughs says it builds a more direct gateway through its CP series of communications processors which handle conversions between SNA and the Burroughs Network Architecture (BNA). A spokesman said that the chief advantage of this is that Burroughs does not have to worry about changes in IBM's terminal specs.

The third part of the strategy is Burroughs' industry-specific plan which has the company focusing on six main areas -- finance, manufacturing, government, health care, education, and hotels. When asked which of these areas are developing most rapidly, a spokesman said that its hospital-wide information system (BHIS) is doing very well as are its on-line teller systems. He added that its reader/sorter line has allowed it to best IBM in lots of bank bids.

Burroughs' disk situation is still a little messy. When it acquired Memorex in the summer of 1981 for about $100 million, it was well known that it would take time to build the interfaces so that Memorex's high capacity IBM-compatible drives could be used on Burroughs' systems. Although this has proven to be the case, the $100 million Memorex price tag now looks like a bargain.

Originally, Memorex's 3380-type drives were expected to be linked with Burroughs CPUs by the third quarter of this year, but due to Memorex production delays and software difficulties that date has been pushed back until early 1985. The company expects to make some kind of statement later this year.

Burroughs is basically accepting a Memorex-first policy in allocating supply-constrained drives. According to a Memorex spokesman, the two companies figure that Burroughs will start getting drives about a year after first shipment of the IBM-compatible version. This should give Memorex time to get its costs down. Once the IBM and Burroughs needs are met, Memorex can take any OEM business that comes its way. The company hopes this three-pronged demand will give Memorex the scale economies needed to stay competitive.

Memorex 3350-type drives have been going out in volume since December on the 6900 and 7900 systems, but even here there are complications. Burroughs is still making similar capacity drives and the two versions are not compatible. Burroughs says that new customers are opting for the Memorex drives, but many older ones are staying with Burroughs, with some conversion occurring.

SIZE CLASS 2-5 MAINFRAMES, U.S. INSTALLED BASE, AS OF 12/82
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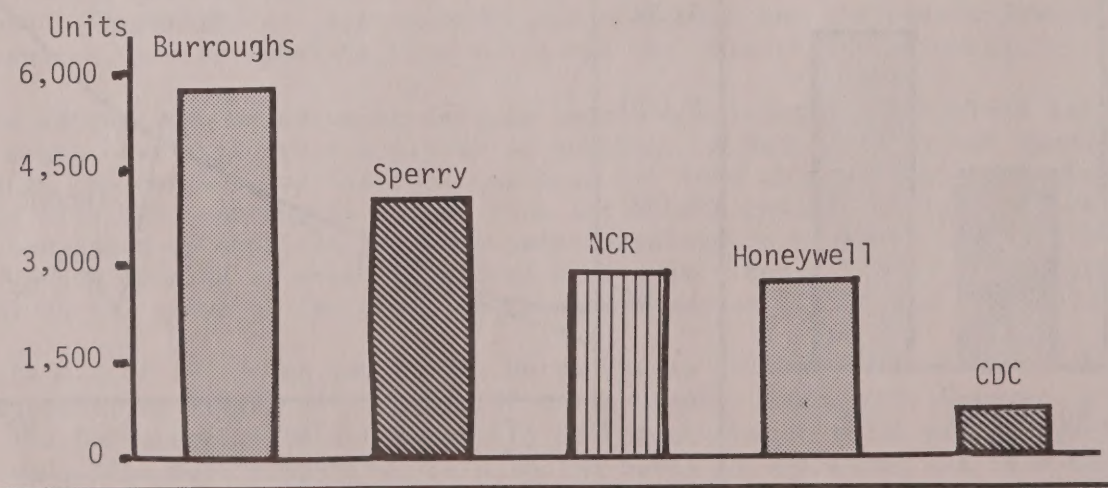

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IBM, AT&T, DEC AND OTHERS MAKE MAJOR UNIX ANNOUNCEMENTS; DIGITAL RESEARCH TO CREATE APPLICATIONS LIBRARY

Large and small vendors alike are tripping over each other trying to climb aboard the increasingly crowded Unix bandwagon. In the last few weeks no less than IBM, AT&T, DEC, DG, Apple, Honeywell, and Digital Research announced major plans, with the Uniforum conference in Washington, DC, the main platform.

The two biggest -- IBM and AT&T -- were also the most surprising. IBM support for Unix has been expected for some time, but most observers didn't expect a single-user version of System III on the XT. Coming out of its obscure Information Programming Services group in Irving, Tx, (and built by Interactive Systems Corp. in Toronto), there is reason to doubt whether the so-called PC/IX has the backing of Boca Raton. It seems geared mainly to program development.

IBM's Unix endorsement is certainly a milestone, but the giant's policy remains in confusion. Three versions have now been announced -- cpix on the Series/1, Xenix on the System 9000, and now System III on the XT. A VM-based Unix system on the 4300s, and System V on a future Intel 286-based system are also expected. IBM is reported to have held several high level meetings recently designed to produce an official and consistent Unix policy. Hopefully, order will be restored before the Unix market takes off

By teaming up with Digital Research (DR), AT&T hopes to attack the problem of the lack of Unix commercial application software. The basic concept is to set up a central library that will collect programs from independents and make sure that they conform to System V standards. The library may also develop some of its own software. AT&T expects the library to have software on the market by the end of the year. If this effort catches on, it can only be a plus for a market that has yet to deliver on its promised portability.

After getting knocked out of the 16-bit market by Microsoft and MS/DOS, DR clearly hopes to make a comeback with Unix. In December, it replaced Microsoft as provider of the Unix port for Intel's chips, and it recently signed an agreement with Motorola to put its Concurrent DOS (which is written in C) and CP/M on Motorola's VME/10 microcomputer. The idea is to move existing applications over to Unix System V machines.

Other Unix announcements

In just about any other week, DEC's announcement of Unix on its Vax line would have been a top Unix story. Deliveries of the Ultrix 32 (Berkeley 4.1) are slated for late spring. DEC had previously announced Ultrix support on its Microvax system, and offers Venix on the slow-selling Pro 300.

As part of its Macintosh and Lisa announcements, Apple announced that it will offer both Xenix and Uniplus for those who want multi-user capability on the Lisa. Such a system would allow Apple II, III, or Mac users to access the Lisa's hard disk. Apple says that support of Unix is its first step toward the multi-user market. Some application software has already been announced.

Others making Unix announcements recently include Honeywell, on an unannounced 68000 workstation; DG with enhancements to UNX/VS; Oracle, which put its relational data base on System V; Absolut Software with a slew of business software; and Gould using Convergent's N-Gen workstation.

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• NAS/IBM SETTLE SUIT. Bringing an end to the 18-month technology theft case, NAS will pay IBM $3 million for its legal fees, and, as in the Hitachi settlement, both sides agreed to resolve future disputes by arbitration. NAS President David Martin maintains that his company settled "for business reasons" -- to avoid huge legal costs and to restore a normal business environment. The spectre of the suit has hurt NAS in many government and commercial bids. The company has maintained its innocence from the start.

• BURROUGHS TO ANNOUNCE LASER PRINTER. Expect the Detroit mainframer to announce a 30 page per minute laser printer within the next few weeks. Called the Model B9290-30, the printer will work with Burroughs' large systems, i.e., 5900 and up. No price or delivery date has been set. The printer was pre-announced in Paris last September. It has been designed by Burroughs and will be built at the company's Orlando, Florida facility.

• CHINA ANNOUNCES ITS FIRST SUPERCOMPUTER. China surprised the world by announcing its first supercomputer which it says can operate at one hundred megaflops. Called the Galaxy, the system has been under development since 1978. The hardware was completed in July of 1982 and has now been used in more 13,000 hours of operation. Observers in China feel that what was once considered a 15-year technology gap has been largely closed in about six years, and many Chinese equate the significance to that country's development of an atomic bomb which also took six years. The Chinese admit that they probably wouldn't have developed their own supercomputer if the West had been willing to sell them one.

• TERADATA ANNOUNCES HUGE DATA BASE MACHINE. The Los Angeles-based company claims that its DBC/1012 Data Base Computer System can handle trillion byte relational data bases at about one-third the cost of the mainframe computer approach. Among those who have shown an interest in Teradata are ARCO, Citicorp, Merrill Lynch, TRW, Stanford University, and many others. The basic system includes six microprocessors, 2.5 MIPS power, 2GB storage, and software for $480,000. Add-on modules are priced at $60,000 per MIP and $37 per MB disk. Initial shipments have already begun. Teradata was founded in 1979.

• AT&T TO HANDLE AMERICAN EXPRESS NETWORK. The new 51-story headquarters of the financial services conglomerate will include an integrated voice and data network to be installed by AT&T Information Systems (ATTIS). A System 85 PBX with six applications processors will be the hub of the network which is expected to handle 15,000 lines and tie together 1,400 data terminals. The value of the sale and maintenance contract for the first five years is over $20 million, making it ATTIS' largest single-location sale to date.

• TRILOGY HAVING PRODUCTION TROUBLES. Troubles with its wafer manufacturing process have forced to Trilogy to delay first shipments until fourth quarter 1985. The latest delay leaves the project one year behind its original plan.

• BELL LABS ANNOUNCES LIGHTWAVE TRANSMISSION RECORD. An experimental optical fiber system can transmit one billion bits per second (equivalent to 20 TV stations or 14,000 phone lines) through 75 miles of fiber without a booster.

• INTEL JOINS BILLION DOLLAR CLUB. 1983 sales were up 25% to $1.1 billion.

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DAVID MOSCHELLA, EDITOR JAN. 13, 1984 ● V/19, NO. 18 P.J. MCGOVERN, PUBLISHER

ALL SIGNS POINT TO A BIG 1984; IBM TO SET THE PACE FOR THIRD STRAIGHT YEAR

The rose-colored glasses are back on. A year ago the recession had everyone talking about industrial policy, protectionism, inadequate R&D, and declining U.S. technological prowess. Today, growth and profits are back, and supply constraints are again a key vendor concern. From semiconductors to mainframes, 1984 is shaping up as a solid year for the industry's major players.

Once again IBM is in the driver's seat. The company has said it expects 1984 growth of at least 14%, and some observers feel the giant could reach the 20% mark. But as the new year begins, it's a good time to take a macro view of things. In this issue, EDP/IR offers a variety of looks at an information industry which is now some 2.5% of the U.S. GNP. Among the key findings:

- Historical comparisons. In terms of rate of installations, computers are being accepted faster than telephones were, slower than televisions, and at about the same rate as automobiles. The charts on page 5 suggest that at least 20 years of strong computer growth remain.

- The economy. Over time there has indeed been a correlation between the growth of the computer industry and the national economy (page 6), although there are some sharp exceptions such as 1982.

- IBM mainframe cycles. Historical patterns suggest that 1984 should be an off year of IBM's 308X class systems (page 2). But IBM says unit shipments will be up some 18%, a tribute to snowballing customer demand, and IBM's rising mainframe market share.

- Capital spending. According to one measure (page 4), the information industry is now accounting for more new capital investment than traditional heavy industries (page 4).

- Real growth. With the low inflation rates of 1982-1984, real growth has been at its highest levels since the 1960s (page 6).

- 1983 performance. Nine month totals suggest a 1983 revenue growth rate of around 12%, and the fourth quarter should raise this slightly. IBM growth will be around 17%.

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SHIPMENT PATTERNS OF IBM SIZE CLASS SIX AND SEVEN MAINFRAMES
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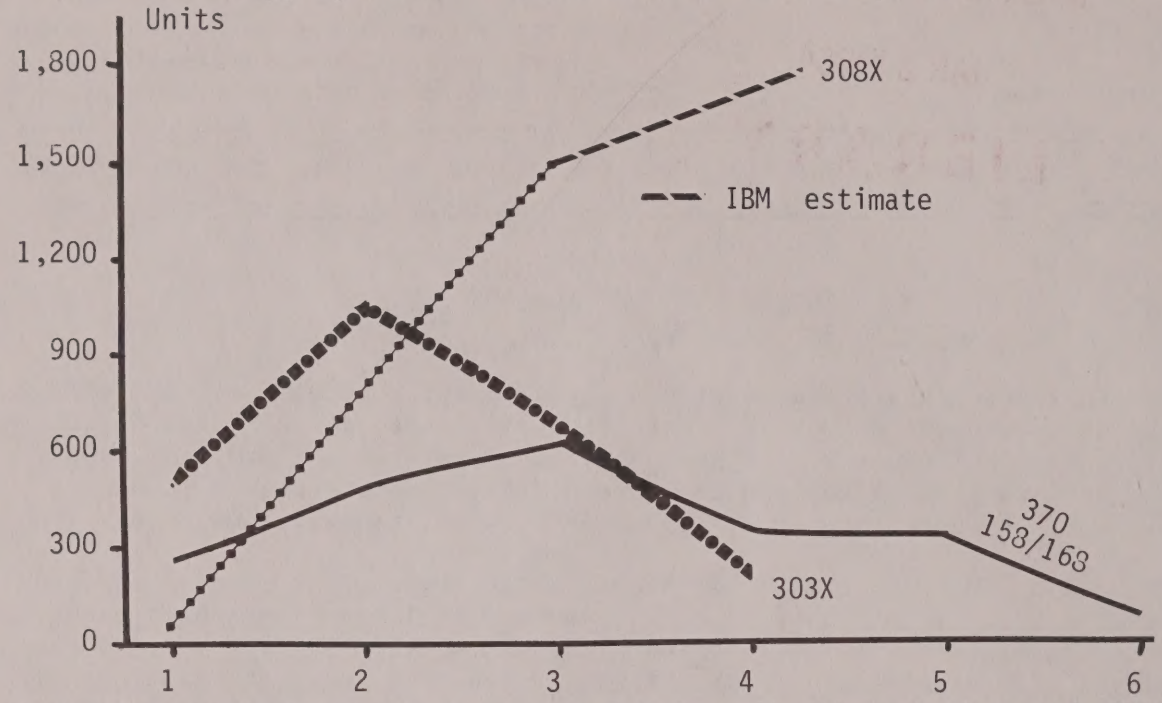

Notes: The vertical access shows annual U.S. unit shipments for each IBM family. The horizontal access shows the number of years since first shipments began. The 308X line is slightly misleading because first year shipments were only for the last three months of 1981. The extension of the 308X line is based on IBM's 18% prediction (see comments below). All other curves are based on IDC data. In addition to the changing shipment patterns, the dramatic increase in mainframe unit volumes is also worthy of note.

IBM tells of 308X shipment increases

Earlier this month, IBM shocked a group of New York Security analysts by noting that it expected its sales of 308X engines to rise by 18% in 1984. As the chart above shows, an historical analysis would have predicted that 308X sales should have either levelled off or started along the down slope, especially since product cycles have shortened since the 370 days.

But IBM's surprising bit of candor is not easily interpreted. IBM refers to "308X engines," counting the dyadic 3081 as two and the uniprocessor 3083 as one. But since 1984 will see a significant amount of upgrades from 3083s to 3081, and from 3081s to 3084s, the 18% figure does not automatically translate into dollar value of shipments. The price of a 3083J to 3081K upgrade is much less than the price of second 3083J, so the shipment of some engines will bring in much less revenue than the sale of new processors.

EDP/IR will be able to measure the extent of this upgrade activity very soon. IDC's annual analysis of IBM migration patterns is nearly complete, and they should be presented in EDP/IR within the next month or two. This study should also give the first hard data for 3084 installations.

As long as 308X shipments remain strong, IBM will have little revenue incentive to speed up the introduction of its Sierra series of large mainframes.

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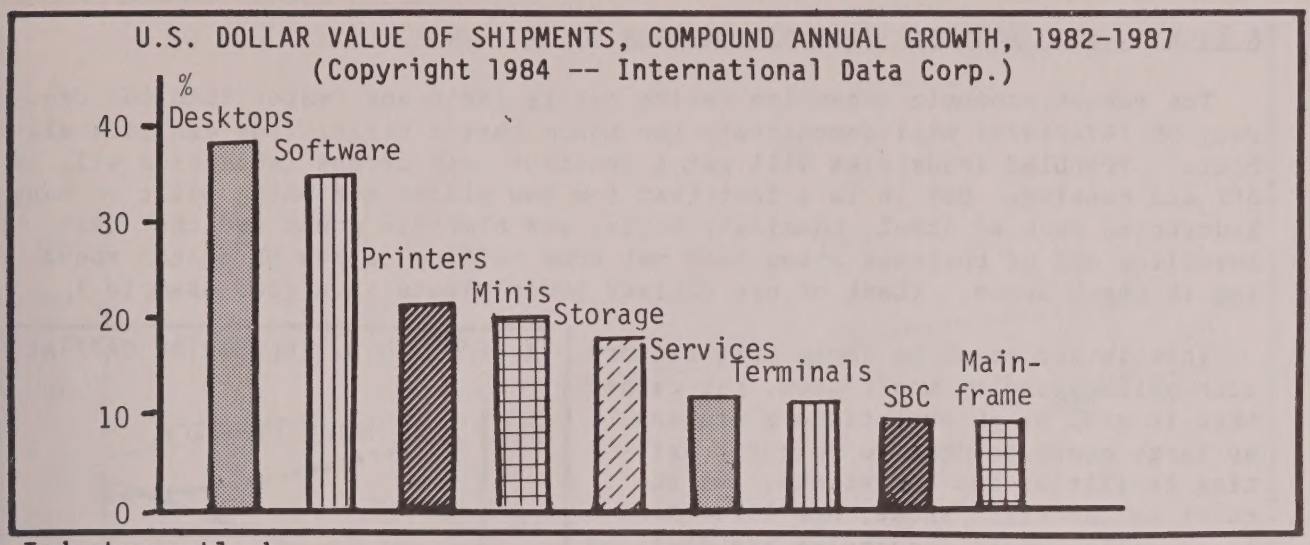

Industry outlook

Always one of the most reliable indicators of vendor production schedules, the semiconductor book-to-bill ratio has soared over the 1.5 mark, and forecasts for semiconductors in 1984 hover in the 30% to 40% range. Key products such as Intel microprocessors, and 64K and 256K RAMS continue to be in short supply, and those vendors that anticipated the turnaround and built up their inventories in advance will be positioned to both increase market share and have better margins since component prices have now firmed up.

The semiconductor demand is broad-based with personal computers, mainframes, automobiles, and the military leading the way. IBM has said its shipments of personal computers will triple in 1984, and with the gush of IBM-compatible PC vendors (as well as Apple's Macintosh and still strong IIE sales), solid demand for chips and disks should continue at least until early 1985.

Chip supplies could be tight for some time, since U.S. makers have been understandably reluctant to increase production capacity over the last few years and Japanese producers are busy with their own expanding domestic market. A supply-constrained environment has a way of quieting protectionist calls.

On the mainframe side, in addition to IBM's bright 1984 outlook, members of the Bunch are showing signs of confidence after several years of almost apologetic annual statements. Recession-induced cutbacks, new products, and improved "coexistence" with IBM will continue the pick-up that began in 1983.

Sperry made a particularly aggressive statement saying that it expects its computer system revenues to double over the next five years (implying 15% annual growth) and that profits will rise at 30% per year. Sperry has won several hefty military contracts and will finally begin shipping its 1100/90s this spring for which it has orders for 60 systems. Sperry also reports that it has sold some $100 million worth of SperryLink systems in the product's first year.

NCR says that it will continue its rapid pace of product introduction in 1984 with new mainframes, transaction processing systems and communications products. It also hopes that its 32-bit chip will be successful in the merchant market. CDC reports lots of new mainframe accounts via its 4300-size Model 815 in CAD environments (Unix support is expected soon). Burroughs is again touting an industry-specific strategy.

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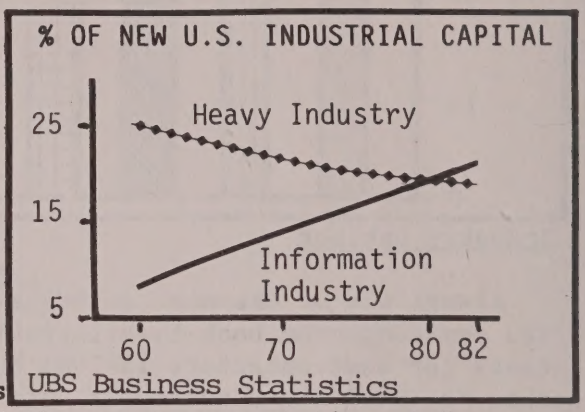
A look at some industry specific sectors

The robust economic expansion (which really isn't any faster than the recovery of 1974/1975) will demonstrate the maxim that a rising tide can lift all boats. Troubled industries will get a breather, and strong industries will be off and running. But it is a fact that few new plants are being built in many industries such as steel, chemical, autos, and electric power and that this levelling off of business sites does put some ceiling on new DP system spending in these areas. (Lack of new nuclear power plants is a good example.)

This is not meant to imply that factory automation spending won't grow, but rather that it will be an evolutionary process, as large companies try to retrofit existing facilities and operations. As the chart to the right shows, new investment in so-called basic industries has declined as a percentage of the whole.

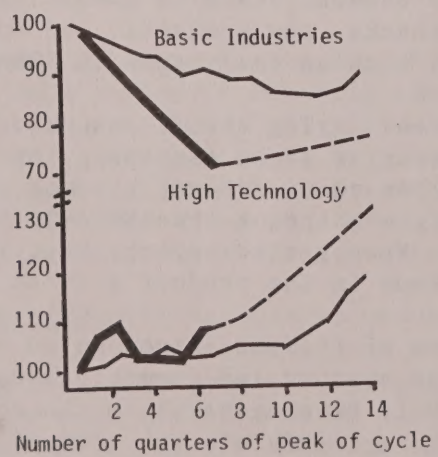


The most significant growth in spending should come in those areas that are both growing and changing. Consider the effects of deregulation which has radically changed the way transportation, telecommunications and financial services companies operate.

Airline, trucking, and railroad companies used to have their routes, rates and profits largely fixed by government agencies. No longer, the inefficient are going out of business, and new companies are entering the market. Merger and acquisition activity is on the rise. Deregulation has increased their decision-making needs and strategic options tremendously, while new competitors have the luxury of designing information systems from the ground up.

Similar changes are taking place in the telecommunications, entertainment, and financial services industries, all of which were growth areas to begin with. As banking, investing, and insurance steadily merge, market shares will shift and flexible computer systems will emerge as key competitive weapon.

ECONOMIC CYCLES AND FIXED INVESTMENT



The chart opposite is based on complicated averaging and statistical techniques which can't be explained here. The point demonstrated is that declining industries ratchet downward and growing ones upward. It is estimated that in the 1980-1982 recession basic industry capital spending dropped 30%, and no matter what the strength of this recovery it is unlikely that capital spending can soon reach the pre-recession levels. In the high technology sector, capital spening flattens in the recession, then recovers faster than average, an upward ratchet.

——— AVERAGE OF FOUR PREVIOUS CYCLES
▬▬▬ 1981/1982 CYCLE
– – – ESTIMATES 1983/1984

Source: Morgan Stanley

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U.S. INSTALLED BASES OF MAJOR INVENTIONS vs. THE POPULATION
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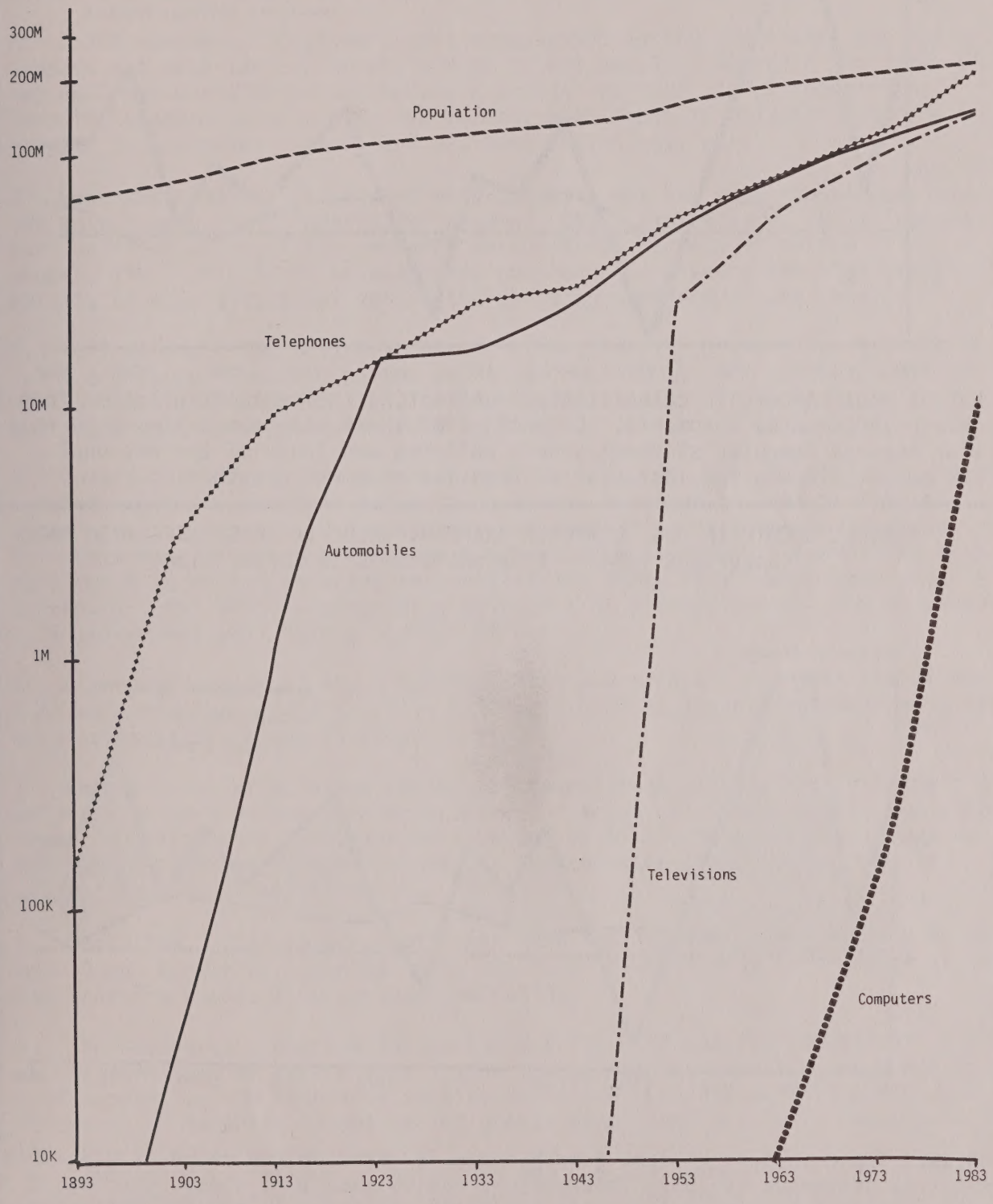

Note. The left hand scale is logarithmic.

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REAL GROWTH IN U.S. DOLLAR VALUE OF COMPUTER SHIPMENTS vs. GROWTH IN REAL GNP
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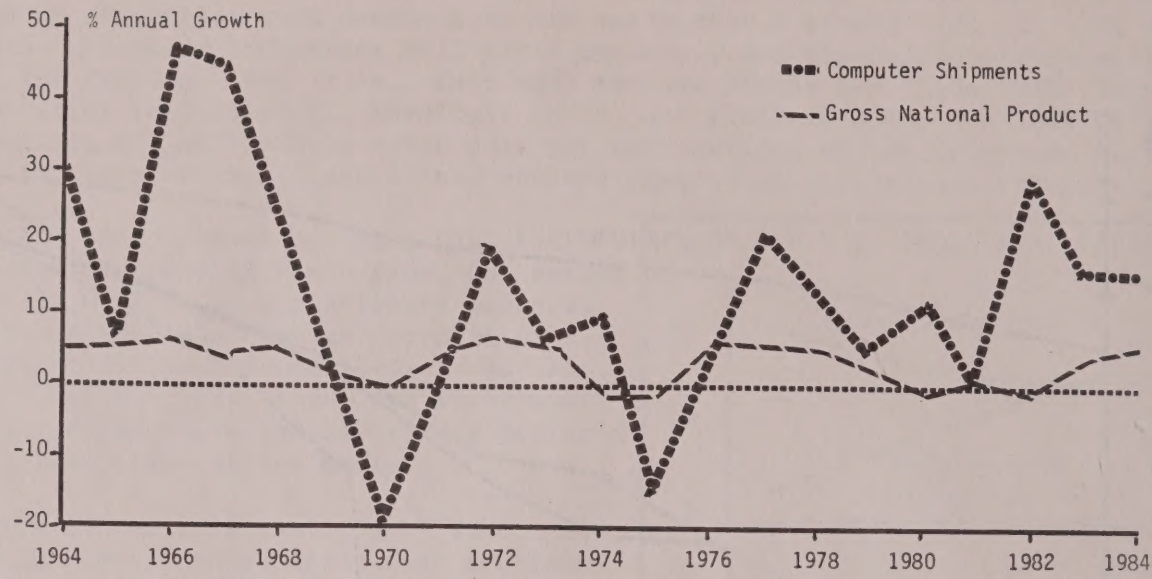

Notes: real growth is calculated by subtracting the rate of inflation from the growth in computer shipments. Up until 1982 there had been a strong correlation between computer shipment growth patterns and those of the national economy. 1975 was the last year of negative shipment growth.

NOMINAL GROWTH IN U.S. COMPUTER SHIPMENT VALUE vs. U.S. INFLATION RATE
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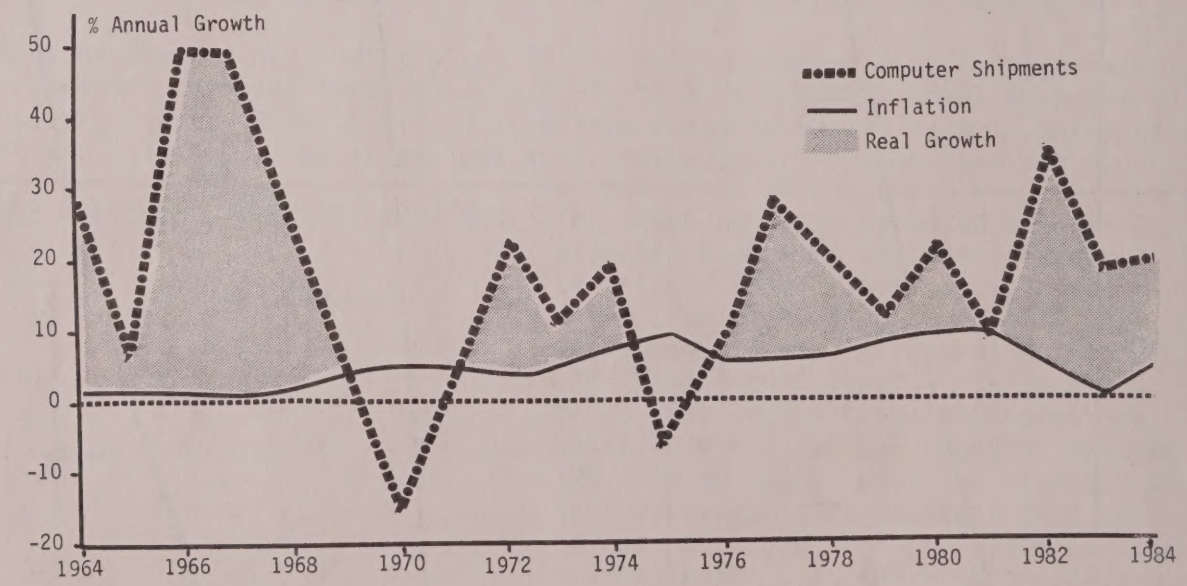

Notes: The computer shipment growth curve is based on the value of U.S. shipments as estimated by IDC. This measure varies much more widely than would industry revenue figures. Inflation estimates are based on the GNP deflator as used by the Department of Commerce. Real growth over the 1982-1984 period has been higher than at any time since the 1960s.

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TEN MACRO TRENDS AFFECTING THE INFORMATION INDUSTRY (Unranked)

1. Deregulation. From communications to transportation to energy to financial services, deregulation is creating new companies and transforming old ones. In virtually all cases, deregulation has produced dramatically lower prices and major competitive realignments.

2. Joint ventures. Customers want broad-based system suppliers, but among vendors not even IBM can be all things to all people. Domestic and international partner-picking has become a crucial part of global competition. Computer vendors join up with PBX makers; AT&T looks to Olivetti and Convergent Technologies; Sperry and DEC bank on Trilogy, etc.

3. Demassification. An awkward word perhaps, but how else can you explain the move toward small independent groups? CDC's ETA systems, IBM's independent business units, STC's research partnerships, scores of custom chip houses, etc. This is an economy-wide phenomena -- witness the high profitability of specialty steel versus the unending problems of big steel.

4. Nationalism. The desire to have a strong local computer industry has led the U.S., Japan, France, England and other nations to form national development projects, either privately or publically funded. There has also been much talk about protectionism (but fortunately little action as yet).

5. Internationalism. Although nationalist politics would have local vendors working together, rational business decisions continue to lead to international joint ventures. U.S./Japanese corporate ties continue to increase, and off-shore manufacturing has become a competitive necessity. Everything from mainframes to micros is being internationally OEMed in mutually beneficial agreements that will continue defy advocates of protectionism. U.S./Japanese auto agreements will have a similar effect.

6. Changing industrial mix. Manufacturing now accounts for just 24% of the U.S. GNP, and the figure is still falling. Even in Japan a movement away from manufacturing has begun to occur.

7. Unions. As deregulation and global competition emerge, artificially high union wages have become a major problem for autos, airlines, steel, and other areas. Dealing with its union will be one of AT&T's toughest challenges as it moves into a deregulated environment. The computer industry has largely avoided any union activity.

8. Marketing. That former Pepsi exec John Sculley and former Phillip Morris exec James Morgan are running Apple and Atari respectively is evidence of the new industry emphasis on consumer marketing.

9. IBM standards. Whereas in the 60s and 70s, IBM and its competitors built up their respective fortresses, in the 80s the entire industry has moved toward supporting IBM standards such as 3270, SNA, DCA/DIA and 370 and PC/DOS software. This shift is not taking growth away from IBM, it is feeding it.

10. Technology insertion. Four years ago, in its summation of the 1970s, EDP/IR noted that the 70s were the decade of the DP shop, and projected that the 80s would be the decade of the office, and the 90s the decade of the home. We don't see any reason to change this scenario.

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• AT&T MAKES TWO BIG MOVES. Showing that it is not afraid to make deals with outside suppliers, AT&T has announced that it will buy 25% of Olivetti for $260 million and that it will sell as yet unannounced exclusive products from Convergent Technologies. There is some potential overlap between the two deals -- workstations, PCs, terminals -- but hopefully this won't be a case of the left hand not knowing what the right is doing.

If nothing else, the Olivetti deal will greatly increase AT&T's ability to market communications products in Europe, where Olivetti's main competitor has been IBM. Even so, the IBM/Rolm combo still seems more potent than AT&T/Olivetti for most datacom tasks. In 1983, Olivetti earned a slim $80 million profit on sales of $2.3 billion. Getting 25% of a company this size for just $260 million implies that Olivetti's stock is not that well thought of. The company has repeatedly stubbed its toes on efforts to crack the U.S. market.

More interesting for the U.S. market is the deal with Convergent, a company with a reputation for innovative products. AT&T has characterized the deal as a "long term relationship," with Convergent developing a line of exclusive products. Convergent currently makes workstations, a portable computer, and a 32-bit supermini. The deal is expected to cover several products, including a workstation. To merit exclusive rights, the contracts must be sizable.

• NCR ENTERS 3270 MARKET. NCR continues to improve its SNA capabilities, this time hitting the clustered 3270 terminal market. Two unique features of its 7950 are the ability to store frequently used sets of words and printer buffer/queuing. NCR plans to have a dedicated sales force that will market to large organizations. Coupled with NCR Comten's IBM compatible front end processors, NCR can now provide substantial IBM terminal subsystem support. Controlling up to 32 terminals, the 7950 system is available now.

• IBM ENDORSES COMSHARE FOR DECISION SUPPORT SYSTEM (DSS). In addition to joint sales calls, IBM and Comshare will work to improve the System W software. But unlike the software OEM deals with UCC and Artificial Intelligence, Comshare's System W is not being sold as an IBM licensed product.

• IBM SHOWS NEW SYSTEM 38. The new Model 6 effectively replaces the model 5 by offering 25% more power for slightly less money. The Models 2, 3 and 5 are field upgradeable to the Model 6 which can be upgraded to the Model 8. In its literature, IBM notes that the Model 6 "should be attractive to customers with large System 34s." Shipments begin in March.

• DEC OPENS PALO ALTO RESEARCH CENTER. The center will be headed DARPA head Robert Taylor and will be separate from the Los Altos, CA, group headed by Forest Baskett. The facility will open in a few months.

• HONEYWELL TO SERVICE COLECO'S ADAM. Honeywell plans to aggressively expand its third party service business. By the end of March it expects to have 35 service centers (up from 5 now) and will add more throughout the year. Contracts had previously been announced with Printronix and Pencept.

• NAS INSTALLS 100th 6600 SYSTEM. National Advanced Systems' 4381 competitor is proving that MVS/XA isn't yet needed to sell mid-range IBM-type CPUs.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

DAVID MOSCHELLA, EDITOR DEC. 22, 1983 ● V/19, NO. 17 P.J. MCGOVERN, PUBLISHER

AT&T DIVESTITURE DAY IS UPON US, BUT MANY TELECOMMUNICATIONS ISSUES REMAIN UNRESOLVED

It's been almost two years since AT&T and the Justice Department agreed to break up the Bell system as a way to settle DOJ's 1974 antitrust suit. Since then much has been said and written, but if you haven't been paying rapt attention, relax; you haven't missed much, and the real chaos has only just begun.

Despite the constant headlines, the only major changes to the original settlement were made by Judge Greene back in August of 1982. Believing that the deal favored the new AT&T, the Judge gave the Bell Operating Companies (BOCs) both the Yellow Pages and permission to market (but not manufacture) customer equipment. He also barred AT&T from electronic publishing for at least seven years. In 1983, the BOCs got rights to Bell Labs' patents and the Bell logo.

The gush of recent publicity is mostly due to a national case of cold feet. The sad state of things is such that two weeks before divestiture few people are convinced that the reigning powers know what they're doing. From Charles Brown to Mark Fowler to Judge Greene to Tim Wirth, no one wants to take credit, or even accept responsibility, for what is happening. The breakup's main architect, Bill Baxter, has left DOJ and gone back to Stanford. Among the issues:

- Reorganization. By dividing AT&T into regulated and unregulated halves, there will still be disputes of where one business ends and the other begins. Remarkably, two years after the settlement, the role of the FCC's Computer Inquiry II has yet to be cleared up.

- Local rates. There is still no political or economic consensus on how to deal with the inherent conflict between the need to have cost-based pricing and the desire to have universal telephone service. This is the one issue that assures continuing Congressional interest.

- Bypass threat. 75% of business long distance revenues are generated by 10% of the customers. If these users adopt network bypass technologies, the implications for the remaining users will be severe.

- The new AT&T. Observers worry about AT&T's falling market share, but it is AT&T's future products and services that will someday determine whether or not the breakup was in the national interest.

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AT&T reorganizations have occurred so regularly that EDP/IR is grateful it hasn't had to report them all. Ditto for the executive power struggle. The latest restructuring also has a look of impermanence about it, but contains some historic changes -- a product line orientation, the virtual elimination of the Western Electric name, and what appears to be the second step toward breaking up Bell Labs. (The first involved the transfer of several thousand Bell Labs people to what was then American Bell, now AT&T Information Systems).

Under corporate headquarters are two divisions -- AT&T Communications and AT&T Technologies. The former is expected to have 1984 revenues of $35 billion and the latter $24 billion. AT&T Communications is essentially the old Long Lines and provides long distance services with rates set by the FCC. AT&T Technologies consists of Bell Labs and seven unregulated business lines:

- Network Systems
- Federal Systems
- Component and Electronic Systems
- Information Systems
- Technology Systems
- Consumer Products
- International Sales

This reorganization is probably not the last one since, according to Computer Inquiry II, AT&T Information Systems must operate as a fully separate subsidiary with no manufacturing capabilities. AT&T argues that the divestiture has made these restrictions obsolete, and EDP/IR agrees. The second expected change involves Bell Labs. To improve accountability, each line of business is taking control over some Lab resources, with only a core group of pure R&D remaining. 10% to 15% of the lab's $2 billion annual budget goes to pure R&D.

Phone service issues

As far as plain phone service is concerned, network bypass and universal telephone service remain the two horns of the dilemma. For years, long distance revenues have subsidized local rates (estimates range from $10 to $12 billion per year). Without these subsidized local rates, users would have even more incentive to bypass the local system. Consider the following facts:

- 75% of all business long distance revenues are generated by 10% of the customers. Additionally, 10% of residential customers account for 50% of residential long distance traffic.

- 60% of WATS revenues come from 10% of the physical locations.

- 40% of U.S. households spend less than $5/month on toll calls.

Cost-based pricing will lower long distance rates and raise local ones. There is no doubt that this policy will have two main beneficiaries -- big business and affluent consumers -- while small businesses and lower income families will suffer. This has rightly prompted Congressional concern since it views long distance service as a luxury and local service as a necessity.

Scheduled to take effect on April 1, the access charges would contribute to increases in local rates (expected to rise 40% to 300% overall) which will cause some people to give up their phones. The argument that the demand for phone service is highly inelastic is unsubstantiated and debatable. Some argue that shared phones and party lines might again become part of the U.S. social fabric. The FCC defends access charges by saying that they are only a small, but highly visible, component of the inevitable local rate increases.

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But those who advocate retaining the long distance subsidies are playing with fire. Long distance bypass technologies are also for real, and everyone from the Department of Defense to Merrill Lynch to the new AT&T knows that if rates don't fall, there are cheaper ways to provide long distance service. The long distance network already has some obsolete technology, but the subsidy aspect sorely aggravates the situation. If the major users desert the telephone network, the impact on the health of the BOCs could be devastating.

Thus, the Congress faces difficult and complex trade-offs. House Bill 4102 talks about bypass taxes, complex rate-freezing schemes, and the establishment of a Universal Service Fund. But AT&T has termed this bill "disasterous," and Congress has a long history of failing to pass telecommunications legislation.

An important side issue is the competition between AT&T and carriers such as MCI. AT&T expects to continue to lose some market share, but the access charge schemes are expected to make it much more competitive. As usual, both sides are claiming that the other has an unfair advantage. Unregulated competitors currently account for less than 5% of the total long distance market.

A look at the unregulated sector

When one looks at AT&T's current hardware it is easy to see why many observers are pessimistic about its short run prospects. It is clear that the Bell Operating Companies (BOCs) will increase their purchases from non-AT&T suppliers (see page 5). At the same time, none of the new AT&T products are ready for the type of immediate growth that could easily offset these losses.

On the hardware front, AT&T's most impressive product is its 256K RAM which it is now making in volume. Although AT&T Technologies plans to sell this chip in the open market, internal demand is expected to soak up much of the production. Currently the 256K chip is used in AT&T's 5E digital switches, its 3B20 minicomputers and its Digital PBXs. In the future the 256K chip is also targeted for AT&T's "smart terminals." AT&T says it is selling all of this equipment "as fast as it can make it," but production levels are still modest.

AT&T has recently resumed construction of its 800,000 square foot semiconductor plant in Orlando, Florida. In addition to custom microcircuits for AT&T use, the plant, expected to be in full swing by 1985, will make 32-bit microprocessors and 256K chips for merchant consumption. Construction was delayed for almost two years for recessionary reasons according to AT&T.

Other key products are the System 85 digital PBX; the Merlin key system; new residential phones; and the 3B20, a one-MIP minicomputer. If the first three can stabilize AT&T's market share in their respective areas, they will have done their jobs. The System 85 has some very sophisticated call management features but still faces strong competition from Rolm and Northern Telecom. AT&T is almost sure to introduce some type of small Unix computer in 1984, and this will be the first real test of its processor competitiveness.

It is EDP/IR's opinion, however, that the big opportunities for AT&T Technologies will be in the area of services, not hardware. The competition in this area is much less formidable and all the great growth is still ahead. A key question is whether AT&T can maintain solid hardware sales until its services and international business are ready for the emerging new markets. (See page 6 concerning the Japanese INS system for an idea of the type of services likely.)

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SOME THOUGHTS TO MULL OVER

The following quotes are from recent remarks made by Charles Brown, chairman of AT&T, to the National Press Club in Washington, D.C.

"To my knowledge there has never been a single elected official who advocated what the Justice Department accomplished."

"The technologies of the information age are basically three -- micro-electronics, photonics, and software. Bell laboratories either invented parts of these and/or is on the leading edge of all of them."

"We believe that over time the long distance field will be deregulated."

"They (MCI et al) pay about one third of what AT&T pays to use the same (local) wires ... it's like a license to steal. ... There isn't any basis for this except the desire to create competitors. It comes about because the FCC ordered it."

"The (house) legislation (HR 4102) is an unmitigated disaster, and I hope the Senate employs its deliberative strength."

"It is not easy to break into the hardware business in foreign countries. ... but it's very expensive to develop a new switching system. There aren't more than four or five companies in the world who are going to be able to keep up with this technology."

"Defense Department people and other government agencies are still very, very worried."

"If access charges are not approved ... heavy long distance users will put in their own facilities. That's the scenario without any doubt."

When asked "Is it not true that AT&T and the DOD will be the biggest bypassers of all?" Brown replied "No."

"This is an industry upon which all other industries depend, and we can not let it deteriorate."

"This wasn't our idea.... But once the genie of competition is out of the bottle it is disasterous to fool around with a half-free, half-regulated organization.

THE BELL SYSTEM, PAST AND FUTURE

	1982 Bell System	1984 AT&T	1984 BOCs (combined)
Revenues*	$ 78.3 Billion	$56.5 Billion	$ 59.6 Billion
Assets	$156.3 Billion	$34.3 Billion	$117.5 Billion
Debt	$ 45.0 Billion	$ 9.5 Billion	$ 36.7 Billion
Net Income	$ 7.6 Billion	$ 2.1 Billion	$ 6.6 Billion
Outstanding shares	849 Million	989.1 Million	685.8 Million
Number of Employees	One Million	385.0 Thousand	588 Thousand

*1984 revenues for AT&T and the BOCs include a significant amount of double counting as revenues collected by AT&T are often passed back to the BOCs for access charges. Actual growth in phone service revenues is about 10% per year.

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Outlook for the BOCs

In February of 1982, the 22 Bell Operating Companies (BOCs) were grouped into seven Regional Holding Companies (RHCs) of approximately equal revenues and assets. It is these RHCs that will have the right to sell equipment or establish subsidiaries. The 22 BOCs exist largely in name only as means to minimize customer confusion. Final P&L responsibility lies at the RHC level.

Ironically, after all the talk about the market value of the Bell name, four of the seven RHCs -- Ameritech, US West, Nynex, and Pacific Telesis -- have chosen not to use it. EDP/IR fails to see how these new names are much of an improvement, but at least they have been a boon to the advertising industry.

A Central Service Organization (CSO) will provide a single point of contact for national security and other emergency requirements. The CSO, which is owned equally by the seven RHCs, will be involved in both long run technical planning and legal and regulatory matters. It is expected to have 9,000 employees, 6,500 of which will be for technical support. Outsiders have criticized the CSO as a way of perpetuating the AT&T old boy network, but Judge Greene rejected these charges, saying the CSO works for the RHCs, not AT&T.

All of the RHCs have indicated that they will re-enter the customer equipment business (including phones, key systems, PBX, modems, etc.), and many OEM arrangements have already been made with companies such as AT&T, GTE, NEC, TIE, Northern Telecom, ITT, and Z-tel. Access to RHC marketing staffs should allow smaller companies to participate in the market without worrying too much about service and distribution issues.

EDP/IR thinks that the RHCs will be most successful in reaching smaller customers used to calling the phone company for their communications needs. More sophisticated users normally already have a PBX and are aware of their alternatives, and thus the RHCs offer no overwhelming advantage. The RHCs argue that if they sell a PBX, the customer has a single contact point for both the hardware and transmission lines, thereby avoiding finger-pointing problems.

Of the major PBX players, only Rolm has not made deals with any RHC. Rolm, of course, already has an excellent nationwide field service and marketing group, and someday it may want to enter joint marketing efforts with IBM, especially as PBX systems begin to carry more data.

The RHCs also have to go to the expense of setting up a separate subsidiary to enter unregulated markets, and this added expense will be a burden in a market where margins are often already low. The FCC has already waived this requirement, which was part of Computer Inquiry II, for GTE and other independent carriers, and the RHCs have requested similar exemptions. One argument for a separate subsidiary is that the RHC's have so much customer information in-house that without a separate entity, they would have a major marketing edge.

Mobile telephones are a potential gold mine for the RHCs, each of which inherited one-seventh of AT&T's Advanced Mobile Phone Service. The FCC also gave them half the frequency spectrum in each of the top 30 markets. Early experiments (see back page) indicate that this market could really takeoff.

For those needing more information about the impact of the AT&T break-up, IDC has a $295 special report AT&T -- Position and Prospects. Call 1-800-343-4952.

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JAPANESE SPENDING HEAVILY TO BUILD COMMUNICATIONS INFRASTRUCTURE

One of the advantages of having a publically owned telecommunications system is that major capital spending and other development plans are the subjects of much public debate. As the Japanese telecommunications monopoly Nippon Telephone and Telegraph (NTT) prepares to spend billions of dollars to upgrade its facilities, it has had to give the type of details that AT&T has always been able to keep secret. Presuming that the Japanese can meet their goals, the following information should give an indication of how the U.S. telecom infrastructure should develop over the next 20 years if it is to keep pace.

The Japanese Information Network System (INS) is the heart of that nation's plan to be an advanced information society by the year 2000. When first announced in 1981, the INS was considered vague and naively futuristic. Lately, however, much more concrete plans have emerged and the project is gaining the enthusiasm of major Japanese businesses. The primary goal of the effort is a nationwide digital network based on fiber optic technology. With this infrastructure in place, new telecommunications services can rapidly develop. Systems such as INS are often called Integrated Services Digital Networks (ISDN).

The Japanese timetable calls for virtually complete digitization of the network by 1990, with most of the major cities converted by 1987. To generate business interest in INS capabilities, NTT plans to offer a model INS service in March 1985. The experiment will take place in Japan's Tsukuba City of Research and Development, a main center of Japanese electronics technology. Although there is a general sense in Japan that once the network is built people will find uses for it, NTT is suggesting the following applications:

- Advanced telephone services/billing
- Electronic mail
- Medical services/information
- Remote billing, i.e., meter-reading
- Entertainment
- Inter-business communications
- Video teleconferencing
- Simultaneous voice/graphic trans.
- Multi-functional facsimile
- Data bases/videotex
- Educational programs
- Public notices
- Transactional services
- Services for the handicapped
- Transmitting moving pictures
- Protocol conversion

Japan is also looking at ways to make its telecommunication industry more competitive, but most of these efforts are centered around increasing the access and resale options for non-NTT firms. Currently, NTT restricts use of its facilities in ways illegal in the U.S. Although there is some talk of NTT divestiture, at this point it seems unlikely. Unlike AT&T, NTT has no manufacturing arm, and thus its procurement policies are the key issue.

Interest in the INS project and telecommunications in general is running high in Japan, and vendors want to get in on things early. IBM Japan has teamed up with Mitsubishi to jointly develop products for the INS, and IBM has asked the Japanese government for permission to build a value-added network.

Some observers believe that NTT plans to spend several hundred billion dollars on the INS by the end of the century, but despite government pressure, in 1983 U.S. firms did just $140 million in business with NTT. By far the most interesting award was NTT's decision to buy AT&T's advanced network management system (Atomics) that uses IBM and DEC hardware. The contract is believed to be worth some $62 million, and will be a key part of the overall NTT system.

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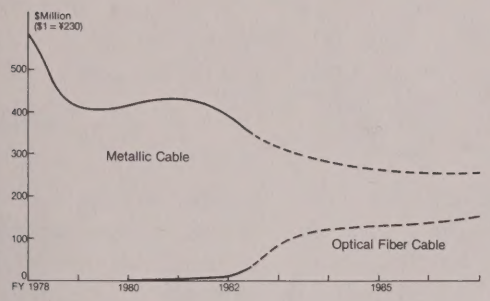
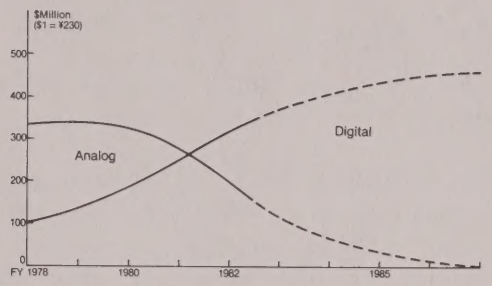
NTT FORECAST OF PROCUREMENT VOLUMES AND TRENDS
(Source: NTT)

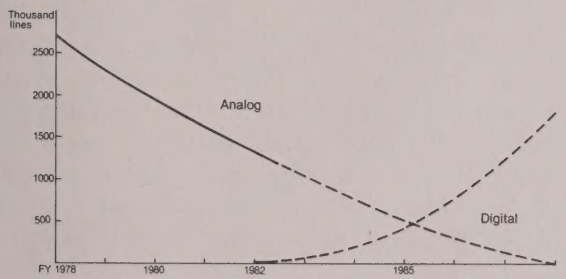
Procurement Amount for Cable



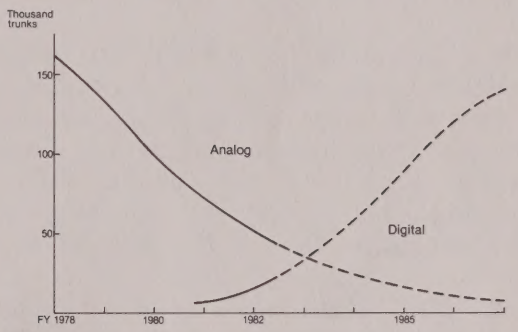
Procurement Amount for Transmission Equipment



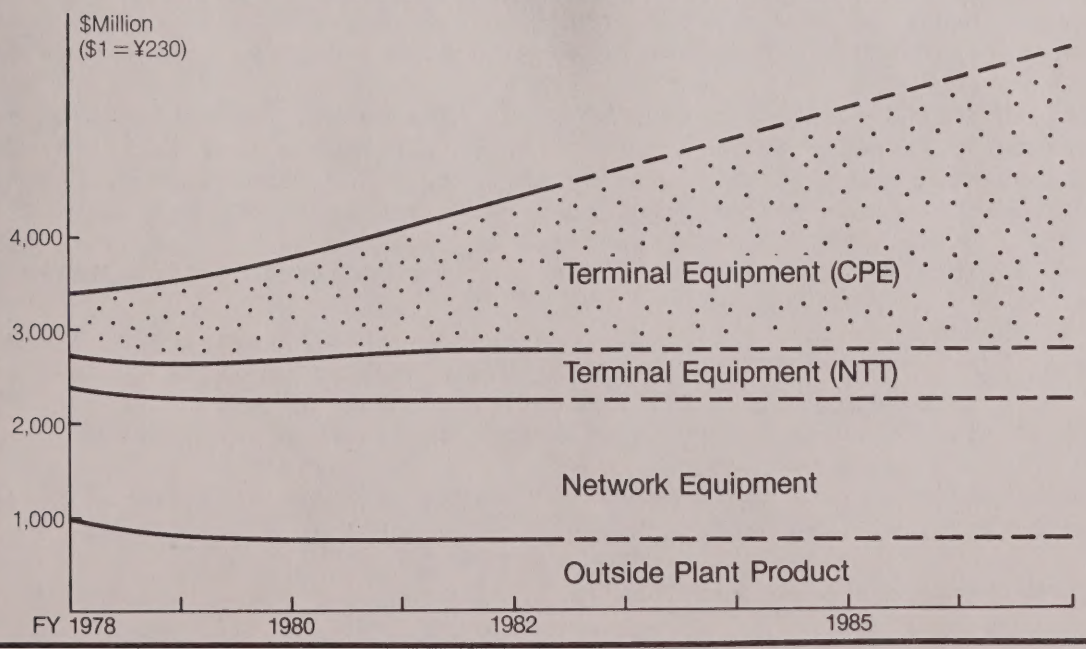
Procurement of Local Switching Equipment



Procurement of Toll Switching Equipment



Public Telecommunications Market



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• IBM TELLS OF A GOOD 1984. In an unprecedentedly specific briefing to securities analysts, IBM said that it expects 1984 revenues to increase more than 14% in 1984, with improving operating margins. IBM also stirred up the audience by saying that it expected to triple its personal computer shipments, and that the sales of 308X CPUs will rise 18%. The PC numbers suggest that the sales of PCs, XTs, and the PC Jr. will be more than 2 million units. The mainframe estimates were surprisingly high, given that a new high-end system will probably be announced sometime in 1984.

• HITACHI SUPERCOMPUTERS ALSO USE IBM SOFTWARE. The embarrassments continue to pile up. Hitachi has asked Tokyo University, its only supercomputer customer, to switch its software contract to IBM because the Hitachi software infringes on IBM copyrights. Details of the IBM/Hitachi agreement continue to trickle out. Hitachi will pay IBM $2.2 to $4.2 million per month for the next eight years for the MVS/SP-like software used on some 400 Hitachi M series systems. There are also undisclosed payments for "interface software," needed to make Hitachi's computers compatible with IBM's. Details of the pact with Fujitsu have not leaked, although the two are believed to be similar.

• AMDAHL TELLS OF NEW OPERATING SYSTEM. The company has finally announced its widely rumored MVS-like operating system, code-named Aspen. The product, slated for delivery in late 1984 or early 1985, is aimed at IBM's weakness in high volume transaction processing software. As large banks and the like plan huge transaction networks, doubts about the suitability of MVS have arisen, but currently the only real alternative is Tandem. Aspen is expected to use a lot less overhead than MVS. Amdahl also offers Unix on its large systems.

• FORD GOES WITH SBS. Ford Motor Co. reports that by next year the Satellite Business Systems will carry about 65% of its interstate voice and data communications traffic between Ford locations and 30% of its long distance traffic to non-company locations such as dealers and suppliers. This traffic is currently being carried on leased and WATS lines. Future plans call for connecting the SBS satellite with an Intelsat V satellite stationed over the Atlantic in order to send traffic from Michigan to Europe. This will enable the company to conduct videoconferences with Europe beginning by mid 1984.

• CHICAGO MOBILE PHONE SALES ARE BOOMING. The market for mobile phones based on cellular radio is here. In Chicago, service by Ameritech, the area's regional holding company (RHC), is way ahead of plan. Some 5,000 users have signed up within three months, and order rates are up to 100 per day. Since the RHC's get half the frequency spectrum in major areas, if they move quickly they may be able to head off the competition before it can fully mobilize.

• E.F. HUTTON, DUN AND BRADSTREET TO SELL PCs. Not surprisingly, the emphasis is on IBM. The IBM PC, the Wang PC, Convergent Technologies portable Workslate and a videotex terminal by Quazon (Carrollton, TX) will be sold to users of Huttonline, while the IBM PC XT will sold to DunsPlus customers.

• DIEBOLD SIGNS UP FOR INTEL SYSTEM 310. The 80286-based board and the iRMX operating system will be used in Diebold's Automatic Teller Machines.

• TYMSHARE/MCDONNELL-DOUGLAS DEAL FALLS THROUGH.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR DEC. 15, 1983 ● V/19, NO. 16 P.J. MCGOVERN, PUBLISHER

VALUE OF STANDARD SINGLE BOARD COMPUTER SHIPMENTS TO GROW 45.1% PER YEAR; INDUSTRY LEADERS TRYING TO CRACK SYSTEMS MARKET

The same standard microprocessors and bus structures that are driving the microcomputer industry have also led to greatly expanded capabilities for single board computers. As industrial and scientific users attempt to incorporate computing capabilities into their specialized equipment, a substantial market is emerging for boards based on 8, 16, and 32-bit microprocessors.

Board level computers compete primarily with custom discrete component solutions, and are used mostly in industrial automation, laboratory and communications equipment. Their key selling points are shorter development periods, lower costs for small quantities, easier upgrades, and the availability of operating system software. Common complaints are poor reliability in high vibration and corrosion environments, and physical size constraints.

International Data Corporation, publisher of EDP/IR, is in the process of developing census information for the entire board industry. Thus far, information on the Multibus, S-100, and STD structures has been compiled, probably representing a little less than half of the overall market. Work on other significant structures -- such as Motorola's VME and Versabus and DEC's Q-bus -- is in the works. Some key points about the market for board level products:

- Market size. IDC estimates that the 1983 worldwide shipments of Multibus, S-100, and STD CPU boards were worth some $306 million. Growth over the next five years will average 45.1%, when the value of shipments for these three segments will be some $1.4 billion.

- Follow-on sales. The actual market for board level products is much greater than the CPU shipments indicate since add-on boards -- i.e., memory, communications, etc. -- often more than double the CPU cost.

- Strategies. Board vendors such as Intel, Motorola, and Compupro are all trying to get into the systems business, an evolution that has proved difficult in the past.

- Open vs. proprietary systems. Most of the proprietary products come from the mini vendors who are finding it difficult to keep up with the price/performance of the latest generation of standard chips.

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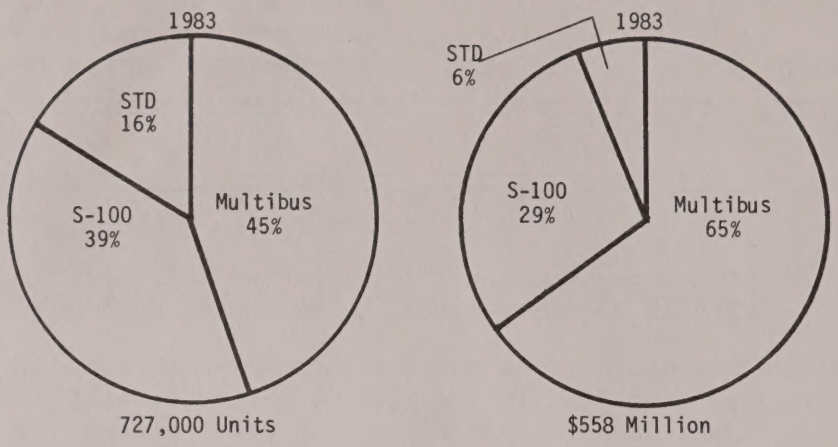
U.S. INSTALLED BASE OF S-100, MULTIBUS AND STD BOARDS
(Copyright 1983 -- International Data Corporation)



Even though most of the board architectures are focused on Intel and Motorola microprocessors, there are significant differences between each category of device. Among the main distinctions are: specific processors supported, use of VLSI components, available software, documentation and support, address range, bandwidth, physical size, types of connections, and single or multiple bus architecture. Common concerns include second sources and control by an outside standards group, i.e., the IEEE.

The market can be divided into high and low-end systems. For the most part, high end systems, such as Multibus and Versabus, can support multiple bus masters, allowing for increased flexibility compared to simple busses such as STD and Q-bus where direct memory access devices and the main processor vie for bus control and can't operate concurrently. Low-end boards are often less than half the physical size of high end products, and this can be important.

Bus structures will continue to evolve, with developments tending to parallel those in the semiconductor industry. Intel has introduced Multibus II to fully take advantage of 32-bit chips. It estimates that there are some 200 companies that make products for Multibus I, which was developed in 1976.

Recently, Intel and Compupro (the leader in the S-100 market) made new entries in the systems market. Intel is pushing its 286/310 system running Xenix, claiming that with the 80287 coprocessor it outperforms a Vax 750 and is the fastest supermicro around. List price is less than $10,000. The Compupro 10 uses an 8088 with multiple Z80s to run 8 and 16-bit programs.

Just about all of the major semiconductor houses have tried to crack the systems market before with little success. But as standard chips and busses become the building blocks for many systems, their task may well get easier. At this point, however, the step from boards to systems is not essential to these companies' success.

TYPICAL BUS APPLICATIONS

APPLICATION AREA	8-BIT	16-BIT	32-BIT
INDUSTRIAL AUTOMATION			
CONTINUOUS PROCESS CONTROL	x	x	
MACHINE CONTROL	x	x	x
AUTOMATED TESTING/INSPECTION		x	x
MATERIAL HANDLING	x	x	
ENERGY MANAGEMENT	x	x	
SUPERVISORY CONTROL		x	x
FACTORY DATA COLLECTION	x	x	
LAB AUTOMATION			
MEDICAL	x	x	
SCIENTIFIC		x	
QUALITY CONTROL	x	x	
DESIGN AUTOMATION		x	x
COMMUNICATIONS			
DIGITAL MESSAGE SWITCHING	x	x	
NETWORK SUPERVISION		x	

Source: Motorola

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SINGLE BOARD COMPUTER MARKET -- U.S.-BASED MANUFACTURERS,
MULTIBUS, S-100, AND STD STRUCTURES ONLY
(Copyright 1983 -- International Data Corporation)

	Number of Systems Shipped	Cumulative Number in Use	$ (000) Value Shipped	$ Million Value in Use
		WORLDWIDE		
1977	19,800	29,000	12,070	18.5
1978	32,300	61,300	21,080	39.6
1979	47,400	108,700	33,420	73.0
1980	80,100	188,800	52,980	126.0
1981	135,300	324,100	93,530	219.5
1982	243,300	567,400	185,440	405.0
1983	355,600	923,000	305,790	710.7
1984	484,300	1,407,300	460,330	1,171.1
1985	639,800	2,047,100	668,800	1,839.9
1986	841,200	2,888,300	954,020	2,793.9
1987	1,098,700	3,987,000	1,356,530	4,150.4
		UNITED STATES		
1977	14,700	21,100	8,850	13.3
1978	24,100	45,200	15,430	28.8
1979	35,300	80,500	24,500	53.3
1980	61,200	141,700	39,420	92.7
1981	105,600	247,300	71,890	164.6
1982	197,800	445,100	149,380	314.0
1983	281,600	726,700	244,140	558.1
1984	368,400	1,095,100	352,570	910.7
1985	465,800	1,560,900	488,350	1,399.0
1986	593,000	2,153,900	670,190	2,069.2
1987	746,400	2,900,300	918,200	2,987.4
		INTERNATIONAL		
1977	5,100	7,900	3,220	5.2
1978	8,200	16,100	5,650	10.8
1979	12,100	28,200	8,920	19.7
1980	18,900	47,100	13,560	33.3
1981	29,700	76,800	21,640	54.9
1982	45,500	122,300	36,060	91.0
1983	74,000	196,300	61,650	152.6
1984	115,900	312,200	107,760	260.4
1985	174,000	486,200	180,450	440.9
1986	248,200	734,400	283,830	724.7
1987	352,300	1,086,700	438,330	1,163.0

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SINGLE BOARD CENSUS

Counts in the Single Board Computer Census are based on the best information available to IDC but are estimates nevertheless. The Census includes only CPU boards that are non-captive (boards that are NOT used internally as components for systems). CPU boards generally fall into two categories: those with just a microprocessor and a timing device, and those that have a microprocessor, clock, RAM, ROM, serial and parallel I/O ports, and other components.

At the present time IDC counts only Multibus, S-100, and STD structures.

S-100 CPU BOARD CENSUS AS OF JANUARY 1, 1983

Name of Manufacturer	Board Model	BUS	Processor Model	Installed Price	Current Price	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Ackerman Digital Systems	ADS 6809	S-100	6809	400	350	06/80	180	20	200	NA
Action Computer Enterprise, Inc.	DPC-180	S-100	280A	1,200	950	01/81	1,750	750	2,500	3,500
	DPC 186	S-100	8086	695	695	01/82	1,750	750	2,500	3,500
						TOTAL	3,500	1,500	5,000	7,000
Advanced Digital Corporation	Super Quad	S-100	Z80A	700	700	11/81	6,300	700	7,000	8,000
	Super Slave	S-100	Z80A	875	875	05/82	1,800	200	2,000	3,500
						TOTAL	8,100	900	9,000	11,500
Applied Systems Corporation	ASC/80	S-100	8085, Z80A	290	290	00/81	320	80	400	NA
Artec Electronics, Inc.	8085ACPU	S-100	8085A	530	450	--/79	1,000	0	1,000	1,500
California Computer Systems	2810	S-100	Z80A	333	325	--/79	2,700	2,700	5,400	1,200
	2820	S-100	Z80A	590	590	--/83	0	0	0	30
						TOTAL	2,700	2,700	5,400	1,230
CompuPro Systems	CPU 86/87	S-100	8086	695	695	02/82	13,500	1,500	15,000	15,000
	CPU 68K	S-100	68000	695	695	10/82	4,000	1,000	5,000	5,000
	CPU8085/88	S-100	8085	495	495	06/80	51,000	9,000	60,000	50,000
	CPUZ	S-100	Z80B	325	325	--/78	24,000	4,000	28,000	10,000
	CPU 286	S-100	80286	1,595	1,595	01/83	0	0	0	10,000
	STD CPUZ	S-100	Z80	335	335	--/80	8,500	1,500	10,000	4,000
	CPU 16032	S-100	NSC16032	695	695	12/83	0	0	0	500
						TOTAL	101,000	17,000	118,000	94,500
Computime	Z80/880	S-100	Z80	268	275	--/80	970	30	1,000	1,500
Cromemco, Inc.	ZPU	S-100	Z80	395	395	09/77	3,600	3,600	7,200	1,200
	DPU	S-100	Z80A	995	995	06/82	160	160	320	600
	ICP	S-100	Z80A	495	495	06/80	900	900	1,800	1,200
	SCC	S-100	Z80	495	495	07/78	2,495	2,495	4,990	1,130
						TOTAL	7,155	7,155	14,310	4,130
Digicomp Research	Z68000	S-100	Z80A, 68000	1,695	1,695	06/82	6	0	6	10
	Pascal-100	S-100	Z80A	1,595	1,695	01/81	3	0	3	35
						TOTAL	9	0	9	45
Dual Systems Corp.	CPU 68000	S-100	68000	900	900	08/81	70	5	75	X
	CPU 68000M	S-100	68000	990	990	05/82	150	50	200	350
						TOTAL	220	55	275	350
Educational Microcomputer Systems	VC8024	S-100	Z80A	350	350	03/82	500	100	600	500
Electronic Control Technology	8080	S-100	8080A	250	250	00/77	100	0	100	130
Empirical Research Group, Inc.	ERG68-696	S-100	68000	1,795	1,795	04/81	100	210	310	500
	SKZ696	S-100	Z-80	495	395	04/80	100	0	100	100
						TOTAL	200	210	410	600
IMS International	MPU-16	S-100	8086	1,150	1,150	10/83	0	0	0	NA
	MPU-8	S-100	Z80A	856	850	--/81	3,300	2,700	6,000	NA
						TOTAL	3,300	2,700	6,000	
Inner Access Corp.	68000-P	S-100	68000	695	695	04/83	0	0	0	100
Intercontinental Microsystems Corp.	CPZ-48000	S-100	Z80A	995	995	04/82	680	120	800	1,000
Jade Computer Products	Big Z	S-100	Z80	200	200	--/79	5,850	150	6,000	400
Logical Devices	QCB-9	S-100	6809	389	389	09/81	250	0	250	X
Lomas Data Products, Inc.	LDP 88	S-100	8088	470	349	04/80	175	75	250	100
	Lightng 1	S-100	8086	525	525	01/82	300	100	400	1,000
	Lightng 286	S-100	80286	1,395	1,395	11/83	0	0	0	50
	Lightng 186	S-100	80186	1,250	1,250	01/84	0	0	0	*
						TOTAL	475	175	650	1,150
MCP Computer Products	MCP/SCC-6	S-100	Z80B	200	200	11/80	380	20	400	500
Measurement Systems and Controls	CPC-2810	S-100	Z80A	427	377	01/81	420	280	700	400
Memory Merchant	Dual CPU	S-100	Z80	0	525	--/84	0	0	0	*
MU Systems Corp.	Net/82	S-100	Z80A	1,095	1,095	12/81	1,800	200	2,000	2,500
Pliceon, Inc.	Superam 50	S-100	68000	1,060	1,060	02/82	90	20	110	220
	Superam 50A	S-100	68000	1,060	1,060	02/82				
	Superam 512	S-100	68000	1,995	1,995	--/83	0	0	0	NA
	Superam 25A	S-100	Z80	575	575	02/82	170	130	300	330
	Superam 25P	S-100	Z80	760	760	02/82				
	Superam 5A	S-100	Z80	575	575	02/82	85	15	100	200
	Superam 5AP	S-100	Z80	475	475	02/82				
						TOTAL	345	165	510	

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Name of Manufacturer	Board Model	BUS	Processor Model	Installed Price	Current Price	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
S.C. Digital	CPUI-Z80	S-100	Z80	219	219	--/80	450	50	500	NA
	Z80CPU	S-100	Z80B	349	349	09/82	180	20	200	NA
						TOTAL	630	70	700	
SD Systems	SBC 200	S-100	Z80A	350	350	--/81	1,170	630	1,800	4,800
	SBC 300	S-100	Z80A	755	755	03/83	0	0	0	1,000
						TOTAL	1,170	630	1,800	5,800
Seattle Computer	SCP-200	S-100	8086	353	297	--/79	638	40	678	310
	SCP-210	S-100	8086	0	245	01/84	0	0	0	*
						TOTAL	638	40	678	310
Sierra Data Sciences	SBC-100	S-100	Z80A	895	895	12/81	1,350	150	1,500	1,500
	SBC-100S	S-100	Z80A	795	795	10/81	1,350	150	1,500	1,500
	SBC-100H	S-100	Z80H	995	995	11/83	0	0	0	350
	SBC-100S/H	S-100	Z80H	895	895	10/83	0	0	0	350
						TOTAL	2,700	300	3,000	3,700
Ski Electronics, Inc.	SK8088	S-100	8088	343	349	02/81	167	8	175	30
SSM Microcomputer	CB2	S-100	Z80	299	299	--/80	4,300	700	5,000	NA
	CB1A	S-100	8080A	252	252	--/78				NA
						TOTAL	4,300	700	5,000	
Systems Group	CPC 2810	S-100	Z80A	495	495	05/81	1,400	600	2,000	1,500
Tarbell Electronics	CPU/IO	S-100	Z80A	450	450	09/79	900	100	1,000	1,000
Teletek Enterprises, Inc.	Systemaste	S-100	Z80A	895	895	04/82	2,000	500	2,500	10,000
	SBC1	S-100	Z80AB	875	875	02/82	800	200	1,000	2,200
	FDC1	S-100	Z80A	695	695	06/81	1,000	200	1,200	230
	SBCII	S-100	Z80AB	NA	NA	--/84	0	0	0	*
						TOTAL	3,800	900	4,700	12,430
Zobex	S-11	S-100	Z80A	490	490	--/78	100	0	100	NA
Other S-100 Vendors	Various	S-100		400	400		1,800	200	2,000	NA
TOTAL S100							157,059	37,108	194,167	

STD CPU BOARD CENSUS AS OF JANUARY 1, 1983

Applied Micro Technology, Inc.	ST4102	STD	Z80	495	495	02/81	270	30	300	150
	ST4101-0	STD	Z80	250	250	03/80	270	30	300	50
						TOTAL	540	60	600	200
Applied Systems Corporation	ASC Z80	STD	Z80	290	290	--/81				
	ASC/80	STD	8085, Z80	250	250	NA	560	140	700	NA
	ASC/85	STD	8085	390	390	NA				
	ASC/88	STD	8088	450	450	--/82				
Axis, Inc.	LSB 7800	STD	Z80A	675	675	12/82	6	0	6	300
Colex America	STD-CPUE	STD	Z80	125	125	--/83	0	0	0	2,000
	STD-68000	STD	68000	595	595	--/83	0	0	0	1,000
						TOTAL				3,000
Computer Dynamics, Inc.	CPU-Z80	STD	Z80	155	155	07/82	244	6	250	400
Contemporary Control Systems, Inc.	S808	STD	8080A	250	250	07/79	50	0	50	5
	S888	STD	Z80	225	225	03/80	100	0	100	150
	S881	STD	Z80	275	275	11/83	0	0	0	25
						TOTAL	150		150	180
Crosspoint Systems, Inc.	STD8085	STD	8085	850	850	10/83	0	0	0	50
Datricon Corporation	ACS-090EM	STD	6809	204	195	01/81	367	90	457	325
	ACS-120EM	STD	6800	295	295	01/81	20	2	22	X
	ACS-140EM	STD	6801	295	295	--/82	5	0	5	X
	ACS-150EM	STD	6512	295	295	--/82	17	4	21	10
						TOTAL	409	96	505	335
Designsmiths, Inc.	Megaproces	STD	8088	750	750	02/83	0	0	0	40
Electrotechnics Corp.	MS1002	STD	Z80	289	289	03/82	75	0	75	100
	MS1004	STD	Z80	314	314	03/82	75	0	75	1,100
						TOTAL	150		150	1,200
Enterprise Systems	10804	STD	6502	338	310	--/81	285	15	300	600
	10809	STD	6809	300	300	--/81	28	2	30	200
						TOTAL	313	17	330	800
Environmental Systems Corp.	RMC-80	STD	Z80	950	950	01/81	125	0	125	150
Forethought Products	STD Z80-1	STD	Z80	230	230	03/83	0	0	0	200
GW Three, Inc.	SBC 95/1	STD	TMS 9995	349	349	09/82	200	0	200	375
I/O Controls, Inc.	885-8KS	STD	8085	325	325	08/78	500	175	675	175
Intersel Systems, Inc.	ISB-3100	STD	Z80	200	200	11/80	400	0	400	300
	ISB-3101	STD	Z80	200	200	06/81	400	0	400	600
	ISB-3110	STD	8085	200	200	11/80	400	0	400	300
	ISB-3111	STD	8085	200	200	06/81	400	0	400	600
	ISB-3103	STD	Z80	700	700	11/83	0	0	0	150
	ISB-3130	STD	8088	370	370	11/83	0	0	0	150
						TOTAL	1,600		1,600	2,100
Ironics, Inc.	IS CPU1	STD	Z80A-B	365	365	--/81	200	0	200	NA
	IR-801	STD	Z80	595	595	--/80	900	100	1,000	NA
						TOTAL	1,100	100	1,200	
JF Microsystems, Inc.	8800	STD	8088	275	275	09/80	300	0	300	400
	8730	STD	8088	740	740	12/82	20	0	20	400
	8759	STD	8088	620	620	12/82	20	0	20	400
						TOTAL	340		340	1,200
Jones	SBZ-02	STD	Z80A-B	595	595	01/82	50	0	50	75

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Name of Manufacturer	Board Model	BUS	Processor Model	Installed Price	Current Price	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Matrix Corporation	7911/CP3	STD	6803	250	250	--/81	200	0	200	300
	7911/CP2	STD	6802	150	150	--/80	350	0	350	25
	7911/SP80	STD	Z80	245	245	05/82	50	0	50	100
	7911/CP80	STD	Z80	190	190	05/82	50	0	50	100
	7911/SP0	STD	6800	190	190	08/82	400	0	400	X
	7911/CP0	STD	6800	175	175	--/80	250	0	250	X
	7911/CP9	STD	6809	190	190	05/82	320	80	400	750
	7911/CP9B	STD	6809	210	210	05/82	480	120	600	750
	7911/SP9	STd	6809	235	235	05/82	150	0	150	500
						TOTAL	2,250	200	2,450	2,525
Micro Source, Inc.	MCPU-64B	STD	Z80A	595	595	01/83	0	0	0	10,000
	STD-68K	STD	68000	695	695	03/83	0	0	0	5,000
						TOTAL				15,000
Micro-Aide Corp.	80-0006A	STD	Z80A	270	270	01/82	47	3	50	130
	80-0006B	STD	Z80B	280	280	01/82	9	1	10	15
	80-0020	STD	Z80A	290	290	07/83	0	0	0	180
	80-0006	STD	Z80	525	525	01/82	47	3	50	130
	80-0018	STD	Z80A	160	160	11/83	0	0	0	10
						TOTAL	103	7	110	465
Micro-Link Corporation	STD-137	STD	8085	195	195	08/82	135	15	150	700
	STD-146	STD	Z80A	195	195	08/82	315	35	350	1,200
	STD-145	STD	8085	250	250	10/83	0	0	0	300
	STD-147	STD	Z80A	250	250	02/83	0	0	0	2,500
						TOTAL	450	50	500	4,700
Micro/Sys, Inc.	SB8010	STD	Z80	270	270	08/83	0	0	0	NA
	SB8010-4	STD	Z80A	295	295	08/83	0	0	0	NA
						TOTAL	0		0	
Microcomputer Systems, Inc.	MSI-7800	STD	8080A	305	280	06/80	100	0	100	100
	MSI-7888	STD	8088	350	350	03/82	100	20	120	200
	MSI-C800	STD	NSC 800-1	420	390	09/81	100	25	125	100
						TOTAL	300	45	345	400
Miller Technology	MCPU-800	STD	Z80A	695	695	04/81	1,000	50	1,050	1,500
Mostek Corporation	MDX-CPU3	STD	Z80A	695	695	02/82				
	MDX-CPU4	STD	Z80A	179	179	11/78				
	MDX-CPU1A	STD	Z80	179	179	11/78				
	MDX-CPU2A	STD	Z80	195	195	12/79				
	MDX-SBC1	STD	Z80	195	195	11/78				
	CPU1	STD	Z80A	215	215	--/79	16,100	7,900	24,000	10,000
	CPU1A	STD	Z80A	179	179	--/82				
	MDX CPU2	STD	Z80A	230	230	--/80				
	MDX CPU2A	STD	Z80A	195	195	--/82				
	MDX CPU3	STD	Z80A	695	695	--/82				
	MDX CPU4	STD	Z80A	375	375	--/82				
						TOTAL	16,100	7,900	24,000	10,000
Octagon Systems Corp.	Sys-10	STD	8070	485	485	06/82	4,000	1,000	5,000	9,000
Peopleware Systems, Inc.	PWS 1010	STD	6801	645	645	11/82	9	1	10	100
	PWS 1080	STD	68008	812	812	11/83	0	0	0	20
						TOTAL	9	1	10	120
Pro-Log Corporation	Z880	STD	Z80A	180	180	11/82	180	20	200	1,000
	Z802	STD	6800	227	235	11/79	800	200	1,000	500
	Z803A	STD	Z80	206	210	02/78	1,600	400	2,000	3,600
	Z801	STD	8085	195	195	02/78	8,000	2,000	10,000	10,000
	78C05	STD	8085	295	295	01/83	0	0	0	500
	78C15	STD	80C85	395	395	01/84	0	0	0	*
	78C13	STD	Z80C	395	395	01/84	0	0	0	*
	7806	STD	Z80	395	395	08/83	0	0	0	500
	7889	STD	6809	205	205	11/82	120	30	150	600
	7885	STD	8085A	185	185	11/82	160	40	200	1,000
	7804-0	STD	Z80A	250	250	02/81	480	120	600	2,000
						TOTAL	11,340	2,810	14,150	19,700
Quasitronics, Inc.	CPU-280	STD	Z80	190	190	06/81	10,200	1,800	12,000	9,000
Robotrol Corp.	RSD-8088	STD	8088	390	390	01/83	0	0	0	NA
Samco	77812	STD	6502	360	360	01/79	125	0	125	100
	778526	STD	6502	400	400	01/84	0	0	0	*
						TOTAL	125		125	100
Sertek	CPU-1850	STD	8085	229	229	01/81	100	0	100	150
Spurrier Peripherals Corp.	STD-Z80	STD	Z80	370	370	03/82	25	0	25	300
	STD-6809	STD	6809	369	369	03/82	20	0	20	100
	STD-68008	STD	68008	NA	NA	04/83	0	0	0	70
						TOTAL	45		45	470
Systek	8800	STD	8088	175	175	06/82	25	0	25	X
	8887	STD	8088	465	465	06/82	75	0	75	300
						TOTAL	100		100	300
TL Industries, Inc.	509	STD	6809	160	160	06/82	10	0	10	50
	580	STD	Z80A	160	160	12/82	4	0	4	15
	585	STD	8085	160	160	02/83	0	0	0	10
						TOTAL	14		14	75
Transwave	K-8073	STD	INS80	338	338	05/81	1,500	100	1,600	2,000
Trebor Industries	ICB-85	STD	8085	450	390	06/80	300	50	350	350
Wintech Systems, Inc.	MCM-SBC-2	STD	Z80	495	495	08/83	0	0	0	NA
	MCM-SBC	STD	Z80	695	695	03/83	0	0	0	NA
XYZ Electronics, Inc.	CPU-80A	STD	Z80	249	249	08/82	100	0	100	200
	CPU-IX	STD	6809	295	295	06/81	50	0	50	100
						TOTAL	150		150	300
Ziatech Corporation	ZT 7805	STD	8085A	650	650	08/81	180	20	200	NA
	ZT 8810	STD	8088	449	449	09/82	40	10	50	NA
	ZT 8811	STD	8088	449	449	02/83	0	0	0	NA
	ZT 8812	STD	8088	425	425	02/83	0	0	0	NA
	ZT 8813	STD	8088	449	449	02/83	0	0	0	NA
	ZT 8830	STD	8088	469	469	02/83	0	0	0	NA
						TOTAL	220	30	250	

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Name of Manufacturer	Board Model	BUS	Processor Model	Installed Price	Current Price	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Zydeco, Inc.	ZTD-085	STD	8085	410	410	01/82	100	0	100	100
Other STD Vendors	Various	STD	Various	700	700	--/78	2,100	400	2,500	NA
TOTAL STD							56,793	15,047	71,840	

MULTIBUS CPU BOARD CENSUS AS OF JANUARY 1, 1983

Advanced Micro Devices	95/4010	Multi	8085A	995	995	06/81	110	40	150	75
	96/4116A	Multi	Z8002	1,995	1,995	04/82	80	20	100	400
	96/4126	Multi	Z8002	2,245	2,245	01/83	0	0	0	50
	97/8605	Multi	8086	1,775	1,775	01/83	0	0	0	500
						TOTAL	190	60	250	1,025
Aim Technology	68000 CPU	Multi	68000	1,690	1,690	04/82	100	0	100	200
	CP8086	Multi	8086	690	690	11/82	10	0	10	100
						TOTAL	110		110	300
Applied Systems Corporation	ASC 8086	Multi	8086	885	885	--/82	80	20	100	100
	ASC/68000	Multi	68000	590	590	--/83	0	0	0	NA
						TOTAL	80	20	100	
Bridge Communications	MCPU	Multi	68000	2,500	2,500	02/83	0	0	0	50
	EC 1	Multi	68000	3,000	3,000	02/83	0	0	0	50
	S I/O	Multi	68000	1,600	1,600	02/83	0	0	0	50
						TOTAL				150
Bubbl-Tec	BBC-128	Multi	Z80A	1,795	1,795	11/82	30	0	30	50
Central Data Corp.	B1017	Multi	Z8001	710	710	--/82	588	30	618	625
Century Computer	V8003	Multi	8088/85	2,200	2,200	05/83	0	0	0	NA
Christian Rovsing Corp. (U.S. Only)	MPMP	Multi	8088	3,125	3,125	--/82	75	-	75	NA
Codata Systems Corp.	68000 CPU	Multi	68000	1,470	1,470	04/81	90	10	100	200
Comark Corporation	MC 85	Multi	8085	986	895	01/80	875	0	875	400
	MC 86	Multi	8086	1,295	1,295	11/82	25	0	25	500
						TOTAL	900	0	900	900
Cosmos Systems, Inc.	CMT-CPU	Multi	68000	2,350	2,350	11/82	45	5	50	50
	Starfield	Multi	68000	3,700	3,700	--/83	0	0	0	500
						TOTAL	45	5	50	550
Cyb Systems, Inc.	CPU 68000	Multi	68000	2,990	2,990	06/82	150	0	150	250
Distributed Computer Systems, Inc.	DCS 86/16	Multi	8086	1,200	1,200	09/80	260	40	300	500
	DCS 86/186	Multi	8086	1,200	1,200	06/83	0	0	0	NA
	DCS 86/286	Multi	8086	NA	NA	04/83	0	0	0	NA
	DCS 8010A	Multi	8080	425	425	--/79	950	50	1,000	NA
						TOTAL	1,210	90	1,300	
Diversified Technology	CBC800/216	Multi	NSC800	994	994	06/81	60	0	60	60
	CBC800/204	Multi	NSC800	863	863	06/81				
	CBC800/24	Multi	NSC800	950	950	11/83	0	0	0	50
						TOTAL	60		60	110
Edge Micro Systems	Edge 86	Multi	8086	1,250	1,250	02/82	45	5	50	150
EMM/Sesco	SECS 86/10	Multi	8086	NA	6,950	03/81	225	25	250	100
	SECS 86/20	Multi	8605	NA	8,950	03/81				
	SECS 80/88	Multi	8088	5,950	5,950	02/83	0	0	0	5
	SECS 80/10A	Multi	8080A	2,850	2,850	11/78	335	40	375	550
						TOTAL	560	65	625	655
ETI Micro	8108	Multi	8085/88	965	965	11/81	98	2	100	200
Fairchild/ Schlumberger	PEP-68	Multi	6809	843	750	--/80	255	45	300	80
	PEP-45	Multi	F9445	1,200	1,200	06/82	181	30	211	800
	VIP-100	Multi	F9445	5,500	5,500	12/83	0	0	0	40
						TOTAL	436	75	511	920
Forward Technology, Inc.	FT68X	Multi	68000	3,150	3,150	--/82	1,450	50	1,500	3,000
	FT68M	Multi	68000	3,495	3,495	06/81	400	100	500	NA
						TOTAL	1,850	150	2,000	
Heurikon Corp.	MLZ-91A	Multi	Z80A	1,844	1,650	05/81	500	0	500	500
	MLZ-90A	Multi	Z80A	1,230	945	07/80	350	0	350	200
	MLZ-92A	Multi	Z80A	1,705	1,675	11/81	750	0	750	1,000
	MLZ-93A	Multi	Z80A	1,970	1,970	01/82	250	0	250	300
	HK-68A	Multi	68000	3,590	3,590	--/83	0	0	0	500
						TOTAL	1,850		1,850	2,500
Intel Corporation	80/04	Multi	8085	NA	NA	--/77				
	80/05	Multi	8085	435	435	--/77				
	80/10A/B	Multi	8080	540	540	--/76				
	80/16	Multi	8080	540	540	09/82				
	80/20-4	Multi	8080	865	865	--/76	120,010	51,490	171,500	34,000
	80/24	Multi	8085	945	945	06/80				
	80/30	Multi	8085	1,565	1,565	--/78				
	88/25	Multi	8088	790	790	11/81				
	88/40	Multi	8088	2,000	2,000	04/81				
	88/45	Multi	8088	1,895	1,895	04/82				
	86/05	Multi	8086	1,645	1,645	11/81				
	86/12A	Multi	8086	1,900	1,900	10/78				
	86/14	Multi	8086	1,900	1,900	10/78	20,720	8,880	29,600	23,000
	86/30	Multi	8086	2,990	2,990	01/82				
	286/10	Multi	80286	NA	NA	07/83				
						TOTAL	140,730	60,370	201,100	57,000
Logitech, Inc. (U.S. Only)	8630	Multi	Z80	1,490	1,490	03/83	0	-	0	NA
	PY8610-CB	Multi	8086	1,490	1,490	09/82	5	-	5	NA
						TOTAL	5		5	
Measurement Systems and Controls	SBC 3200	Multi	68000	2,100	2,100	09/83	0	0	0	200

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Name of Manufacturer	Board Model	BUS	Processor Model	Installed Price	Current Price	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Metacomp, Inc.	MPA-1010	Multi	8086	2,195	2,195	08/83	0	0	0	NA
	MPA-1020	Multi	8086	NA	NA	08/83	0	0	0	NA
	MPA 2000	Multi	186	2,995	2,995	03/83	0	0	0	250
Micro Industries	MIB 80/04	Multi	8085	2,830	2,830	08/82	170	6	176	264
	MIB 501	Multi	8085	6,770	6,770	08/82	125	0	125	188
	MIB 80/05	Multi	8085	NA	NA	11/83	0	0	0	NA
	MIB 80/20	Multi	8080	NA	NA	11/83	0	0	0	NA
	MIB 80/30	Multi	8085	NA	NA	11/83	0	0	0	NA
						TOTAL	295	6	301	
Microbar Systems, Inc.	PBC68K	Multi	68000	1,825	1,825	03/82	50	25	75	400
	GPC86-532	Multi	8086	1,570	1,570	02/81	300	10	310	400
	C86-52	Multi	8086	1,190	1,190	12/80	20	3	23	20
	DBC86-50	Multi	8086	1,410	1,410	03/82	50	10	60	100
						TOTAL	420	48	468	920
Monolithic Systems Corp.	MSC 8001	Multi	Z80A	870	870	12/77	1,869	330	2,199	490
	MSC 8004	Multi	Z80A	1,664	1,100	12/78	1,142	285	1,427	700
	MSC 8007	Multi	Z80A	1,854	1,100	12/79	697	78	775	200
	8009	Multi	Z80A	1,970	1,219	11/81	442	47	489	250
	81861	Multi	80/185	2,280	2,280	05/83	0	0	0	133
						TOTAL	4,150	740	4,890	1,773
National Semiconductor	BLC-80/204	Multi	8080A	760	760	--/79	9,000	1,000	10,000	
	BLC-80/05	Multi	8085A	405	405	--/78	3,375	375	3,750	
	BLC-80/10	Multi	8080A	448	448	--/77	12,150	1,350	13,500	
	BLC-80/11	Multi	8080A	395	395	--/78	10,800	1,200	12,000	
	BLC-80/14	Multi	8080	465	465	--/78	2,700	300	3,000	
	BLC-80/11A	Multi	8080A	395	395	--/81	6,750	750	7,500	21,000
	BLC-80/14A	Multi	8080	465	465	--/78	675	75	750	
	BLC-80/316	Multi	8080A	445	445	--/81	4,050	450	4,500	
	BLC-86/05	Multi	8086	1,600	1,600	--/82	6,750	750	7,500	
	BLC-86/12B	Multi	8086	1,900	1,900	--/81	675	75	750	
	BLC 80/24	Multi	8085	875	875	--/81	2,160	240	2,400	
	BLC 80/116	Multi	8080A	700	700	--/81	450	50	500	
						TOTAL	59,535	6,615	66,150	21,000
NEC Electronics USA, Inc.	BP 0186	Multi	8086	1,595	1,595	07/81	280	120	400	500
	BP 0188	Multi	8088	2,095	2,095	07/82	280	120	400	500
						TOTAL	560	240	800	1,000
Omnibyte Corporation	OB68K1	Multi	68000	1,495	1,495	00/81	1,000	114	1,114	1,500
Pacific Microcomputers	PM68K8	Multi	68000	1,990	1,990	09/81	3,000	400	3,400	2,500
	PM68K10	Multi	68000	2,390	2,390	02/82				
	PM68D10	Multi	68000	2,990	2,990	02/83	0	0	0	1,250
	PM68D8	Multi	68000	2,590	2,590	02/83	0	0	0	1,250
						TOTAL	3,000	400	3,400	5,000
Raster Graphics	RG-801	Multi	Z80A	595	595	08/82	200	50	250	300
	RG-802	Multi	Z80A	995	995	06/83	0	0	0	200
						TOTAL	200	50	250	500
Relational Memory Systems	RSBCZ80/32	Multi	Z80A	1,095	1,095	--/78	200	10	210	500
SBE, Inc.	M68K	Multi	68000	1,695	1,695	03/83	0	0	0	800
Sibthorp Systems, Inc.	MB-100	Multi	Z80A	695	695	03/81	400	0	400	300
Single Board Solutions	MB8000	Multi	Z800X	1,345	1,345	08/83	0	0	0	200
Systemathica Consulting Group	DBC 1880	Multi	8188	795	795	06/83	0	0	0	500
	DBC 1860	Multi	8186	795	795	06/83	0	0	0	500
	MBC 8000	Multi	8080	600	600	03/80	1,000	50	1,050	250
	MBC 16000	Multi	8086	795	795	06/80	940	60	1,000	250
						TOTAL	1,940	110	2,050	1,500
Systems Group	SBC 3200	Multi	68000	NA	NA	10/83	0	0	0	50
Thomas Engineering	MZ-80	Multi	Z80B	1,200	1,200	06/82	113	12	125	550
	MX-68K	Multi	68000	2,000	2,000	10/83	0	0	0	25
						TOTAL	113	12	125	525
TSD Display Products, Inc.	M60139	Multi	68000	1,245	1,245	05/81	1,000	0	1,000	2,000
	M60141	Multi	68000	750	750	05/81	1,000	0	1,000	2,000
	M60146	Multi	68000	725	725	05/81	1,000	0	1,000	2,000
	M60144	Multi	68000	800	800	05/81	1,000	0	1,000	2,000
	M60155	Multi	68000	525	525	--/82	350	0	350	1,000
						TOTAL	4,350		4,350	9,000
Zendex	ZX 80/15	Multi	8085	550	550	--/80	126	54	180	100
	ZX 86	Multi	8086	1,695	1,695	--/82	70	30	100	300
	ZX 85	Multi	8085	2,660	2,660	--/80	35	15	50	20
	ZX 88	Multi	8088	2,750	2,750	--/82	7	3	10	4
	ZX 82	Multi	Z8002	1,995	1,995	--/82	2	1	3	4
						TOTAL	240	103	343	428
Zydeco, Inc.	Ext. Proc.	Multi	8085	1,200	1,200	03/81	100	0	100	250
Other Multibus Vendors	Various	Multi	Various	700	700	--/77	3,000	500	3,500	NA
TOTAL MULTIBUS							228,605	69,830	298,435	

NOTES NA) Data is not available.
X) Board is no longer manufactured.
*) Shipments will not commence until 1984.

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EDP industry report

"The Gray Sheet"

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

DAVID MOSCHELLA, EDITOR DEC. 13, 1983 ● V/19, NO. 15 P.J. MCGOVERN, PUBLISHER

UNIX PLAYERS GATHER AT STARTING LINE, BUT BETTER HARDWARE AND IBM BLESSING NEEDED TO KICK OFF THE RUSH

To date, the Unix market has been mostly a lot of background noise. Unix systems have had price/performance problems, while business software and smooth user interfaces have been hard to come by. Most of the action so far has been limited to vertical markets -- CAD/CAM, graphics, program development, etc.

Yet despite this slow start, Unix looms as one of the dominant forces in the industry over the next five years. With the exception of very low cost products, virtually the entire industry will pay some sort of homage to Unix as vendors incorporate the powerful 16- and 32-bit chips that will soon be available.

Semiconductor vendors are working closely with Western Electric; startups see Unix as the logical operating system choice; third party software houses are mobilizing; and established vendors are carefully plotting their response. Even the peripheral market will be affected as Unix's I/O-intensive architecture triggers demand for high performance drives. For those with a macro view, Unix offers IBM vs. AT&T, the industrial battle of the era. Some key points:

- Unix versions. Unix System V is emerging as the big winner. Enthusiasm for Xenix has faded some and demand for System III ports has just about come to a halt. Adherence to AT&T standards should become even more important as new Unix releases are issued.

- IBM's entry. The consensus of the rumor mill is that IBM will announce an Intel 286 System V product sometime in 1984. The IBM entry will probably emphasize ease of configuration and support.

- New players. Unix will be at the center of a whole new group of vendors trying to integrate and package standardized components and peripherals into 32-bit systems. This rush is already well under way.

- Major vendor reaction. Reactions range from kicking and screaming to trying to catch the market on the rise. Most prefer their own software, which, though often valid, is a short run point of view.

- Market size. At Comdex, a Western Electric executive confirmed an estimate that there are now about 100,000 Unix machines installed.

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Circuit technology the driving force

Over the 1984-87 period, powerful 16- and 32-bit microprocessors will be the heart of both low cost multi-user systems and powerful single-user machines. The Intel 286, Motorola 68020, National 32032, BellMac 32, and the like will essentially put the power of a Vax 11/780 on a chip with full virtual memory capability. These so-called supermicros are already threatening the market for traditional minis, and they can provide an attractive alternative to personal computers in environments where an integrated data base is desirable.

Over the last dozen years, the microprocessor industry has produced four generations of chips -- 4, 8, 16, and now 32 bits. In many ways, the move to 32 bits is the most significant. 32-bit chips can support multi-user systems; they can handle mainframe and mini architectures with large addressing, multitasking and high precision requirements; and, perhaps most importantly, they mark a bit of an architectural resting point since there does not seem to be much interest in pushing the race on to 48 or 64 bits. Although much faster chips will follow, in the future the main task will be one of integrating standard chips, operating systems, peripherals, bus structures, and user software.

Unix will not establish aggressive price/performance levels until this integration is achieved. Thus far, most Unix systems have been based on Motorola's 68000 with its large linear address space, but because of memory management and throughput problems, some vendors have had trouble handling the four-to-sixteen user configurations they advertise. The recent availability of high performance winchesters -- such as those by Atasi -- has helped ease this situation.

Software issues

Just as CP/M dominated the 8-bit world and MS/DOS controls the 16-bit market, Unix looks like a shoo-in as the de facto 32-bit non-proprietary standard. Alternatives such as Pick, Oasis, UCSD p-System and MP/M are not generating much momentum. Although mini operating systems -- VMS, AOS, etc. -- are more developed and powerful, this situation could change quickly. As third party products emerge, vendors of proprietary software may find it hard to keep pace.

This third party mobilization is already well under way. Although the great majority of vendors are still writing for MS/DOS first, there is a growing recognition that the Unix market offers less fierce competition and often better margins. Although Unix is still rather unfriendly, this problem should disappear since perfectly fine user interfaces can be built on the basic Unix shell.

At Comdex, this activity was visible but largely lost among the din of MS/DOS. DEC has signed an agreement with Horizon Software for that company's Unix-based office automation software -- WP, spreadsheet, etc. Numerous other software and hardware vendors -- such as Onyx and Sidereal -- showed Unix business programs, and many more are in the development stages. Consultant Jean Yates estimates that some 400 vendors are now developing Unix software.

The increase in Unix porting activity has meant new business for industry leaders Unisoft and Microsoft, as well as Digital Research, Human Computing Resources, The Santa Cruz Operation, and a half dozen others. Unisoft says that a typical OEM spends about one year and $200,000 porting Unix on its own. Unisoft charges from $20,000 to $50,000 for its 68000 implementations. In November, it stopped contracting for new System III ports.

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Western Electric position

It is perhaps a little more than just good timing that the emergence of Unix has so closely coincided with the deregulation of the Bell system, and 1984 looms as a big year for both. It was only about a year ago that Western Electric didn't even support Unix. Now it is taking out splashy ads in major media touting Unix as the de facto 32-bit standard, and Western will soon extend Unix support to non-DEC hardware.

At Comdex, Western Electric vice president Jack Scanlon spoke about his company's overall Unix strategy. Scanlon noted five key objectives: improve software portability; expand the third party software market; quicken application development; implement new architectural concepts (specifically mentioning Risc) and provide networking services. He noted that 90% of the computer science majors in the U.S. have been exposed to Unix; in Europe the figure is 50%.

A steady stream of future Unix enhancements can be expected -- among them windowing, data base management, file protection, and multi-processing. These new releases will pose a challenge for the lookalikes, since enriching their operating system will get increasingly expensive. Those who modify Unix or build lookalikes face the trade-off of designing a product for today's market versus securing future compatibility. At some point a reconcilition with the System V standard appears likely for most. Western has close relations with UCal Berkeley and will implement Berkeley enhancements as it deems advisable.

For Western, the challenge is to turn loose the independent software vendors while still maintaining portability. Western has developed a series of tests: if a vendor matches these criteria, it can consider itself System V-compatible. At present, the semiconductor houses working with System V -- Intel, Motorola, National Semiconductor, and Zilog -- are the only ones who have access to these tests. Software houses will probably get them later. There are observers who question whether true portability will be maintained as the chip vendors begin to aggressively compete with each other for System V design wins.

Western plans to continue its policy of only selling source code licenses (currently priced at $43,000). When the buyer resells the object code to the end user, Western receives an undisclosed royalty. The price of these object licenses is usually proportional to the cost of the hardware -- $500 to $800 on PCs, thousands of dollars on mini-size systems. For the $55 billion AT&T, the current level of Unix royalty payments represents a rather trivial sum.

Unix service and support costs are still too high. In an effort to simplify Unix and to allow for greater price flexibility, Western will soon unbundle Unix's 400 utilities into as yet unspecified modules. Someday, the company expects that multiuser systems will be simple enough to be sold through retail channels, and Western is now talking about the need to improve its "warmware." Plexus has just opened east and west coast Unix customer support centers.

For Western, an unresolved question is how well Unix acceptance will translate into sales of AT&T computer systems. As long as Unix systems consist mostly of standalone boxes, Western's advantage over other Unix suppliers does not seem that great, unless it can come in at a very aggressive price which some vendors fear. Once complex networking starts to matter, the AT&T advantage may emerge. The ability of Unix to run on any size machine will be a great plus as the industry moves into an era of mainframe-to-micro connections.

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Hardware tacks

At this point it has become essential that minicomputer vendors at least pay lip service to Unix support, since Unix is a knockoff on many RFPs, especially those by the government. But the general reaction of many of these vendors is that they claim not to understand the industry's fascination with Unix which they view as a half-baked operating system not well suited for many tasks such as transaction processing. Among those making Unix announcements at Comdex were Pertec, Callan, Sidereal, Altos, NCR, Ridge, and Onyx.

Among the major vendors, perhaps the most enthusiastic supporter of Unix has been NCR. The company's 68000-based Tower system is doing well in the OEM world, although hoped for sales to large end users have been slow to develop. NCR has shipped about 1,000 Tower systems which are 68000-based and run Unix System III plus Berkeley and NCR enhancements. NCR will (by second quarter 1984) support System V, while retaining compatibility with existing software.

DEC, of course, is the key mini player. Because both the Bell system and the nation's universities are such major customers, it knows that it must support Unix, and that it must do it in a timely manner. Thus far, DEC has only announced Unix support on the MicroVax and its beleaguered Pro 300 PC, but DEC is also known to have a group that is trying to make Unix run under VMS, a coexistence strategy that could catch on with other mini makers.

IBM has the ability to control the pace of Unix acceptance. Although there is no way IBM could make Unix go away, it could retard development by keeping both its users and the software community busy with other systems. But since IBM wants to counter AT&T wherever possible, EDP/IR expects that IBM will make a fairly strong Unix bid. It needs a system to replace the ailing Datamaster, but a full-blown Unix supermicro might well step on the toes of the new System 36 family. It's not easy to be all things to all people.

IBM already offers a version of Unix on its Series 1, and it is expected to put Xenix on its 68000-based system from IBM Instruments. Like Intel, IBM may ride both Xenix and Unix for a while, but the System V standard should eventually prevail. IBM has recently been running ads for Unix programmers at its Thomas Watson Laboratories. Unix on the 4300s is also expected soon.

As for the start-ups, everyone is trying to become the Convergent Technologies of the Unix world. There is a widespread belief that once IBM and AT&T announce their Unix supermicros, other major vendors will start to aggressively seek major OEM Unix arrangements. Given supermicro economics, this makes sense, but the candidates are many, including Onyx, Plexus, Callan, Sidereal, Integrated Business Systems, Motorola, and Pixel.

Conclusion

It is perhaps ironic that as 1984 commences AT&T and IBM will not only begin to compete with each other, but each will be in control of a crucial set of de facto standards. IBM is in total command of the mainframe and PC markets, but Unix gives AT&T a chance to thrive in the mid-range system market. As operating systems take on increasing sophistication, control over their direction will be a major determinant of future hardware markets. Once Unix systems proliferate, AT&T may not want to make things so easy for non-AT&T Unix vendors, just as IBM sometimes makes life miserable for its PCM rivals.

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LOTS OF NEW DISKS AT COMDEX; EMPHASIS SHIFTS TO HIGH END 5.25" WINCHESTERS

Despite being a $15 billion subsector of the information processing industry, disk drive makers don't seem to get all that much attention. Thus, it's not surprising that major trade shows are generally overrun with disk announcements; it's really the only time these manufacturers can get the press's ear.

This year's Comdex was no exception, with the action appropriately centered on disks for personal computers and high performance drives for supermicros. Among those making announcements were Shugart, Syquest, Drivetec, Atasi, Seagate, Vertex, and at least half a dozen others.

Despite the strong market demand to supply winchesters for IBM's PC XT and its competitors, many of the recent 5.25" announcements have been aimed at the high performance sector, competing with traditional 8" drives. Atasi has had much of this market to itself thus far, but the competition will begin to catch up in 1984. Seagate wanted to acquire Atasi to get into the high performance arena, but the negotiations have recently fallen through. Vertex estimates that about 250,000 high performance drives will be shipped in 1984.

EDP/IR looks at the high performance part of the market as those 5.25" drives larger than 30MB and with access times less than 40 milliseconds. In contrast, the low-end is characterized by drives in the 5-25MB range with access times usually longer than 50 milliseconds. Various technologies also differentiate the two classes including media, heads, and actuators. Prices for high performance drives are generally two to three times higher, about $1,700 in OEM quantities compared to around $750 for 5-10MB drives.

There has been a great deal of speculation that the eight-inch market is dead, that high capacity 5.25" and large 14" disks will meet most of the industry's shared system needs. This seems overstated. Vendors of 5.25" winchesters are talking about maximum storage in the 300MB range, leaving plenty of room for 8" disks in the 200 to 900MB range. Seagate surprised a lot of people by announcing an aggressively priced 8" drive although it only holds 100MB. NEC just introduced a 520MB 9" drive that features 15ms access time.

Whenever new capabilities are introduced, some sort of standard battle inevitably emerges. In the high performance arena, the debate is between the current ESDI standard and the ST412HP, based on Hewlett-Packard formats. Most observers interviewed at Comdex saw the HP approach as better suited to high performance applications, but agreed that no clear winner is ready to emerge.

Half-height winchesters are also gathering momentum. Although they make up only a small fraction of current shipments, Andrew Roman of Cogito Systems estimates that by 1986, half-height drives will account for a little over half of all 5.25" winchester shipments. Most of these drives will probably have two platters, although one-platter versions will be available.

As to the sub-5.25" winchester market, there are a growing number of skeptics. The market may not get going unless IBM shows interest and IBM seems to have big plans -- including in-house manufacturing -- for 5.25" drives. Unless high volume standardized products can be produced, sub-5.25" drives may have trouble competing with the 5.25" drives. CDC has just withdrawn its 3.5" drive to add more capacity, improve access times, and lower costs.

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WORLDWIDE UNIT SHIPMENTS, PCS, FLOPPIES AND SMALL WINCHESTER DRIVES
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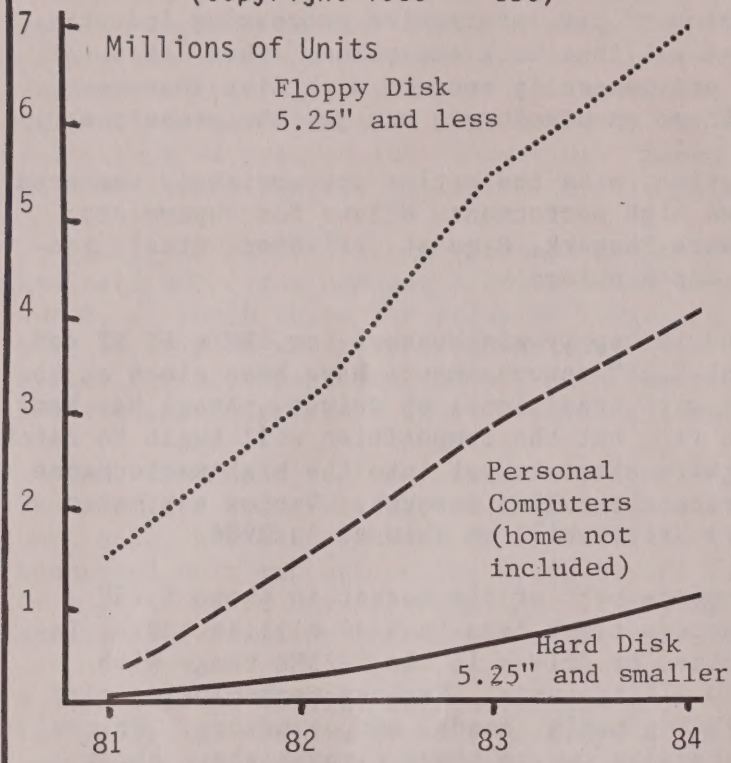
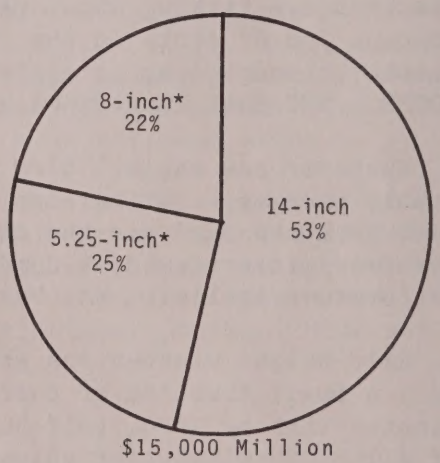


One of the key determinants of the future shipments of both floppy drives and low capacity winchesters will be the extent to which local area networks lead to shared system resources. Although such networking schemes are generating some business, EDP/IR feels that disk prices will come down quickly enough so that local storage will be cost effective in most situations. The motive behind the LAN solution will, most likely, be the need to share data and printers not to cut disk costs. IDC forecasts that the worldwide market for winchesters 5.25" and smaller will grow at an average rate of 62% over the 1982-1987 period, reaching some 2.5 million units. EDP/IR regards this as a fairly conservative figure.

Expect 5.25" winchester prices to continue to fall. Although not much progress has been made in using fewer parts or in simplifying manufacturing, as volume increases, prices are expected to fall at least 20-25% per year. Vertex states flatly that within two years a 100MB 5.25" drive will sell for $1,000 in OEM quantities. These low prices have already got some vendors thinking about making large capacity drives out of multiple small winchesters, just as start-ups are now building high-powered CPUs out of multiple microprocessors.

Adaptec, makers of VLSI controllers, estimates that some 50% of the cost of the IBM PC is in the disk subsystem, and thus there is also a lot of pressure at the low end to reduce costs. Thus far the Japanese haven't had much impact, and probably won't until the winchester market settles down a bit.

SEGMENTATION WORLDWIDE DISK MARKET (COPYRIGHT 1983 - IDC)
* includes floppy disks



Perhaps the strongest boost to the sales of low-end winchesters is the emergence of integrated software packages such as Lotus 1-2-3 which now requires multiple diskettes. A winchester coupled with a floppy drive will be a much more convenient machine. The issue of winchester back-up remains unresolved with high capacity floppies (such as Drivetec's 3.3MB floppy or Shugart's new 1MB floppy), streaming tapes, and removable winchesters all having proponents.

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SPERRY ENTERS IBM-COMPATIBLE PERSONAL COMPUTER RACE; TALKS LARGE SYSTEM STRATEGY

Sperry's announcement of an IBM-compatible personal computer was surrounded by lots of hoopla about a new Sperry -- making deals with outside parties, a new, marketing-oriented management, and a desire to serve parts of the information processing world long off-limits to a company with an admittedly stodgy past.

Well, time will tell. EDP/IR thinks that if the 8088-based, Mitsubishi-built PC can keep IBM PCs out of loyal Sperry shops, it will have done its job. Any large OEM contracts or retail distribution successes will be gravy.

Perhaps more interesting is the fact that the PC is "the first of a new family of desktop computers and micro systems." When asked if this meant that Sperry intended to build multi-user, IBM-compatible systems, a Sperry executive said only that the company is committed to building "more industry standard products." Whether this means IBM, Unix or both is not clear.

Sperry already has close manufacturing ties with Mitsubishi which makes Sperry System 80s. Mitsubishi has also developed 4300-size, IBM-compatible CPUs, although it recently announced that the availability of those machines has been delayed for at least two years (see EDP/IR Vol 19. No 14, Page 3).

Sperry, of course, has also spent about $40 million dollars for 15% of Trilogy Systems, currently designing high end IBM-compatible CPUs. As part of that deal, Sperry has agreed not to build or sell any IBM-compatible products using Trilogy technology before 1992. Although 1992 may sound like a long way off, in the mainframe world this is only two generations of equipment away. Sperry believes that the Trilogy system will set a new standard for high end reliability, although it recognizes Hitachi's current excellence in this area.

Sperry will not begin shipments of its high end 1100/90s until April of 1984. The follow-on generation of systems is due sometime around 1988. Currently, Sperry expects to use Trilogy technology in this system, but in-house development work is continuing. According to a Sperry official, a decision whether to go in-house or use Trilogy technology will be made in mid-1984. The official definitely expects Trilogy to win because in Sperry's opinion "the technology works."

None of this is to say that Sperry is going to be a supplier of IBM-compatible systems, but the company clearly has this option readily available, and given its large base of high-end customers (second only to IBM), supplying IBM compatible machines in addition to the Sperry line does not seem unreasonable. The company reports that orders for 1100/90 machines remain strong. Sperry is also working on a micro version of the 1100 architecture. Such a machine running Sperry's Mapper or Escort could be appealing to its large customers.

Getting back to the new PC, the device can communicate with Sperry CPUs and will eventually be able to hook up to Sperry's office system Sperrylink. Sperry elected not to use the Intel 186 because bit-compatibility could not be maintained; it also echoed a sentiment that the 286 will be available soon and that there may not be much point in using the 188 or 186. The company expects to ship around 100,000 systems in 1984, and has hired the reknowned artist Jean-Jacques Sempe (best known for New Yorker covers) as part of a major upcoming ad campaign. The Sperry Personal Computer becomes available in January.

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• IBM-COMPATIBLES FLOCK TO COMDEX. Sperry, Tandy, ITT, Applied Computer Techniques, and OSM were among the PC clones hoping to underprice IBM, while offering better graphics and performance. The Tandy announcement is notable for its marketing shift. For this product, the name Radio Shack has been dumped in favor of the much less well known Tandy. The Tandy machine also incorporates the Intel 186. Meanwhile, both Honeywell and Control Data are expected to OEM IBM-compatible systems from Columbia Data Products.

• MCDONNELL DOUGLAS SCOOPS UP TYMSHARE. The Tymnet packet-switched network is the key to this deal. Given its recent poor financial performance and the overall sluggishness in the timesharing business, Tymshare could not keep up with the capital spending needed to keep the network growing. The agreement in principle calls for a purchase price of about $380 million. As inter- and intracompany data communications increases, the packet nets have a bright future, selling both public and private datacom solutions.

• XEBEC TO BUY IBM ROBOTS. As part of its plans to build a "people-less clean room," Xebec expects to install some 50 robotic systems from IBM. The systems will handle automatic testing of PC boards, insertion of odd-form components, and assembly of winchester disks. Xebec has previously specialized in making high quality disk controllers, but is now getting ready to build its own drives. It claims that the order, which it expects to be about $16 million, is the biggest robotics contract yet for IBM's Advanced Manufacturing Systems group. IBM will provide technical assistance and support.

• HONEYWELL ENTERS THIRD PARTY SERVICE BUSINESS. Members of the Bunch continue to diversify to take better advantage of their organizational capabilities. Honeywell has signed two 5-year contracts to service the printers of the Printronix and the terminals of Pencept in the U.S. The Penpad product allows users to handwrite information into a computer. Honeywell says it expects to build a nationwide third party service business for telecommunications, peripherals, and microcomputer-based equipment. Honeywell has some 3,700 service workers in 250 U.S. locations.

• DEC TO SUPPORT MICROSOFT WINDOWS ON RAINBOW. The Rainbow will continue to be DEC's industry standard box, and it is easily outselling DEC's PDP-like Professional computer. DEC has just added Unix and UCSD p-system to the Pro system, which now seems to be limited mostly to application development tasks.

• PANASONIC ENTERS U.S. PORTABLE MARKET. What differentiates this MS/DOS portable from its competitors is its built-in thermal printer along with a 9" CRT. The printer can print 132-character lines which is nice for spreadsheets. The machine weighs 29 pounds with prices from $2,500 to $3,500. Panasonic expects to "limit itself" to 800 store locations, and it won't use distributors. The so-called Sr. Partner system will be on dealer shelves in March.

• THOMSON CSF ENTERS OPTICAL DISK MARKET. At Comdex, the French manufacturer showed a one gigabyte non-erasable 12" drive that supports the SCSI interface used with many mini and micro systems. Thomson, which has development agreements with Xerox, says the drive will be priced in the $6,000 to $9,000 range. Evaluation units have already been shipped with production shipments slated for second quarter 1984.

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DAVID MOSCHELLA, EDITOR NOV. 21, 1983 ● V/19, NO. 14 P.J. MCGOVERN, PUBLISHER

IBM CONTINUES TO LEAN HARD ON JAPANESE PCMs; MITSUBISHI BACKS OFF ON IBM-COMPATIBLE ENTRY

"We believe that every company is entitled to the rewards of its own research and development, and that includes research on software. I would think that any company, including my own, is entitled to protection by those (copyright) laws." -- John R. Opel, Chairman of IBM, October 28, 1983, Tokyo, Japan.

Ever since the dismissal of the Justice Department's antitrust suit, IBM has rarely missed a chance to let people know that it is serious about invoking its copyright privileges. Suits against Hitachi, Mitsubishi, NCR Comten, Cybernex, and Bridge Technology helped set the mood, but only now, after major software concessions from Hitachi and Fujitsu, has the full scope begun to emerge.

For years, Hitachi and Fujitsu have built operating system software by duplicating IBM software and then adding Kanji processing and other unique capabilities, allowing them to compete with IBM on grounds other than pure price/performance.. For a decade, IBM quietly watched it all, even though it is company policy not to allow anyone to modify its software for resale purposes.

Now IBM is playing the copyright issue for all it is worth. In an agreement not directly related to the heavily publicized technology theft case, Hitachi will pay IBM an estimated $300 million (IBM won't comment on the figure) for the right to continue to sell its existing IBM-like operating system software.

But the agreement covers "primarily previously developed software," and is not believed to cover MVS/XA-related programs. A top Hitachi official has commented that it may take the company two or three years to rebuild its software so that it does not violate IBM copyrights. Hitachi has recently withdrawn VOS 3/SP, its equivalent of MVS/SP 1.3. Since much of the agreement has not been made public (at Hitachi's request), much confusion persists.

At the time of the law suits against Hitachi, IBM is also believed to have warned Fujitsu that it would file copyright violation suits unless Fujitsu recognized IBM's rights. Fujitsu rejected these claims, saying that its software was original and that copyright laws in Japan were not established. But fear of bad publicity supposedly forced Fujitsu to make concessions this summer. On October 20, Fujitsu admitted paying IBM an undisclosed amount, and an agreement similar to that with Hitachi has been worked out.

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MAINFRAME INSTALLED BASE IN JAPAN -- HITACHI, FUJITSU, AND IBM
(SOURCE: IDC's EDP Japan Report)

Model	Estimated MIPS Rate	First Customer Shipment	# Installed (As of 1/1/83)	Comparable IBM Model
		HITACHI		
M-150	0.4	6/77	200	370-138
M-160II	0.3	9/75	100	370-148
M-170	0.8	8/76	155	370-158
M-180	2.4	1/76	140	370-158
M-140H	0.33	1/80	245	4331-1, 11, 2
M-150H	0.51	1/80	185	4341-9, 10, 1
M-160H	1.0	1/80	150	4341-11, 2, 12
M-200H	7.8	1/80	45	3033
M-240H	2.5	6/82	95	4381-1, 2
M 240D	1.5	12/82	2	4341-2, 12, 4361-5
M-260H	5.7	6/82	36	3083-B
M-280H	14.2	3/82	30	3081-K
M-280H AP	24.7	3/82		3084-Q
L-450	0.13	10/83	-	--
L-450	0.25	10/83	-	4331-1, 11
M-220D	0.45	9/83	-	4331-2
M-220H	0.65	3/83	-	4341-9, 10
M-220K	1.0	3/84	-	4361-4, 4341-1, 11
M-260D	4.1	9/83	-	3083-E
M-260K	7.5	9/83	-	3083-J
M-280D	10.5	9/83	-	3081-G
Total			1,383	
		FUJITSU		
M-130	0.1	6/78	65	370/115
M-140	0.2	12/77	45	370/125
M-160S	0.3	11/77	25	370/138
M-160	0.68	8/76	60	370/148
M-180II	2.0	6/77	157	370/158
M-190	4.2	4/76	8	370/168
M-130F	0.18	6/79	430	4331-1
M-140F	0.33	7/79	425	4331-11, 2
M-150F	0.43	12/79	220	4341-9, 10, 1
M-160F	0.72	12/79	295	4341-11, 2, 12
M-170F	1.66	4/81	180	3031, 3032
M-200	7.0	12/78	74	3033
M-380	14.7	4/82	18	3081K
M-382	25.0	8/82	2	3084Q
M-310	0.25	12/82	25	4331-1
M-320	0.35	3/83	-	4331-2, 11
M-340R	0.55	9/83	-	4341-9, 10
M-340S	0.84	9/83	-	4361-4, 4341-1, 11
M-340	1.4	9/83	-	4361-5, 4341-2, 12
M-360R	2.0	9/83	-	4381-1
M-360	2.9	2/83	-	4381-2, 3083-E
M-360AP	4.9	2/83	-	3081-B
M-380R	7.5	6/83	-	3081-J
M-380S	10.5	2/83	-	3081-G
Total			2,029	

IBM

Model	First Shipment	Installed (As of 1/1/83)	Model	First Shipment	Installed (As of 1/1/83)
370-115	4/74	30	4341-1	2/80	275
370-125	8/73	25	4341-2	9/81	160
370-135	9/72	20	4341-10	6/82	55
370-145	4/72	10	4341-11	6/82	50
370-155	7/71	2	3031	7/78	130
370-138	2/77	60	3032	7/78	50
370-148	4/78	25	3033-S	6/81	10
370-158	8/73	80	3033-N	3/80	25
370-168	12/73	28	3033-U	6/78	90
4331-1	6/79	272	3081-D	9/81	65
4331-11	6/79	45	3081-G	11/82	10
4331-2	12/80	103	3081-K	9/82	30
Total					1,650

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The third black mark is Mitsubishi's recent announcement that it will delay its entry into the IBM-compatible market for at least a few years. The decision coincided with the Hitachi and Fujitsu accords, as well as Mitsubishi's plea of "nolo contendere" in IBM's technology theft suit against it. Mitsubishi was expected to announce 4300 size machines last month and says the delay was needed to improve compatibility with its current Cosmo series of CPUs.

The events are crucial to the future of the increasingly competitive Asian marketplace where Fujitsu and Hitachi have been gaining share. It appears that Hitachi and Fujitsu will be allowed to continue to modify and market their current software, but their ability to match future IBM products is questionable. That Mr. Opel would attend a press conference in Japan shows that IBM is giving the issue top priority and publicity. More details are sure to follow.

Recent stories about the IBM/National Semiconductor (NS) suit have been inaccurate. Charges against NS and its National Advanced System subsidiary were filed along with the original complaint against Hitachi in June of 1982, and they are the only charges that remain unresolved. They got back into the news when IBM suggested that the value of materials in NAS's hands was around $750 million. This does not mean that IBM is planning to sue for this amount.

Unlike Fujitsu and Hitachi customers, users of NAS and Amdahl gear purchase IBM software. Thus, software copyrights aren't the key issue; the debate will be over how much use NAS made of illegally obtained IBM information. Given IBM's track record in this case and others, NAS has cause for concern. Both NAS and Amdahl have promised customers MVS/XA support by April 1984.

COMPUTER INDUSTRY LEADERS TIGHTEN GRIP AROUND PERSONAL COMPUTER MARKET; INSTALLED BASES PROVIDE SOLID FOUNDATION

The PC products from the major vendor entrants -- IBM, DEC, Wang, NCR, HP, Honeywell, DG, etc. -- have proven that building competitive PCs is not particularly difficult. All have brought out solid products that fit in reasonably well with their customer bases and long term strategy, while demonstrating once again their knack for avoiding head-on "me too" price competition with IBM.

Their emergence, however, has nothing to do with the numbing losses felt by Texas Instruments and Atari, or the sudden collapses of Osborne and Computer Devices, and it does not necessarily spell doom for smaller PC vendors. As with software and peripherals, there will always be small vendors who do something better than IBM, and better meet some user needs. As PCs become part of the DP mainstream, industry history is repeating itself. Some key points:

- Software pricing. As complex software gets sold on low cost systems, operating system pricing strategies have proved tricky.

- Operating systems. IBM's VM-based PC 370 and DEC's MicroVAX assure that MS/DOS, Unix, and CP/M will not have the PC arena to themselves.

- Hardware. IBM's XT 370 (based on two 68000s and an 8087) shows that proprietary chips are not always needed to run proprietary software.

- The engineering market. Always a harbinger of new technology, the scientific market has been a safe haven for many workstation start-ups. The new products from IBM and DEC are unlikely to change this.

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Software differentiates PCs, complicates pricing

Support for their respective operating system software has emerged as the best way for major vendors to differentiate their PCs. IBM, Honeywell, and Data General have already gone this way, and DEC, Wang, HP and others aren't far behind. Most -- IBM, Honeywell and DG -- have put MS/DOS and the proprietary software in the same box, while DEC at this time is just offering the scaled-down minicomputer software -- RSX on the Pro 350, VMS on the MicroVax.

As large companies start selling their own operating systems on low cost systems, the software pricing area becomes complicated. Vendors find themselves facing three less than satisfactory options: charging different prices for virtually the same software product, selling low cost hardware with expensive software, or lowering overall software prices.

IBM is charging a one-time fee of $1,000 for the VM CMS software on its PC XT 370, compared to typical VM software fees of more than $2,000 per year on small 4300-class systems. The high performance versions of VM that run on larger 308X mainframes can cost up to $20,000 per year. IBM notes that the VM system software on the PC is designed to call down most of the software it needs from a 370-type host. The charge for doing this is 6% of the large system's monthly fee for that software. Billing is based on the honor system.

Honeywell takes a three-tiered approach to the licensing of its GCOS 6 software. For its new micro 610 system, the license charge is bundled into the hardware price as is most routine support. For the slightly larger S/20 and 40, the same software costs $1,375 per year for the primary license. GCOS 6 on the larger systems 45, 75, and 96 costs $2,500/year for the primary license.

DEC is still sitting on the fence. The MicroVax (with part of the CPU made by Seeq) was introduced without a software price for either VMS or Ultrix (Unix). A spokesman said that the products are still being tested and a formal price may not be available until perhaps as late as March. VMS licenses on the Vax 730, 750, and 780 are all $20,000 for a one-time fee. A spokesman noted that VMS prices for the Microvax will probably be much less.

At some point, IBM must make some long term decisions about PC operating systems. Right now, the confusion centers on MS/DOS vs. VM/370, but Unix and SSX are lurking in the background. IBM's recent advertising tries to make the distinctions as clear as possible. The VM machine is billed as a scientific and professional system, while the MS/DOS 3270 version is aimed at the wider market of less experienced users, the PC for the large IBM customer.

A key question is whether software houses will build personal computing packages -- spreadsheets, WP, etc. -- for the VM version. If this develops, IBM could move toward a proprietary PC, a tack not without appeal, especially as the market matures. There are some spreadsheet packages for VM 4300 users -- such as from ADRS -- but they have not proved particularly popular.

Thus far, third party activity appears limited, except among some software tool vendors adapting existing products. Unlike the original PC announcement, the XT/370 was not introduced with a lot of fanfare about third party applications, and EDP/IR has not seen much evidence of XT/370s popping up in the major micro software houses. IBM is encouraging third parties to build XT/370 software, but for now the emphasis seems to be on modifying existing 370 programs.

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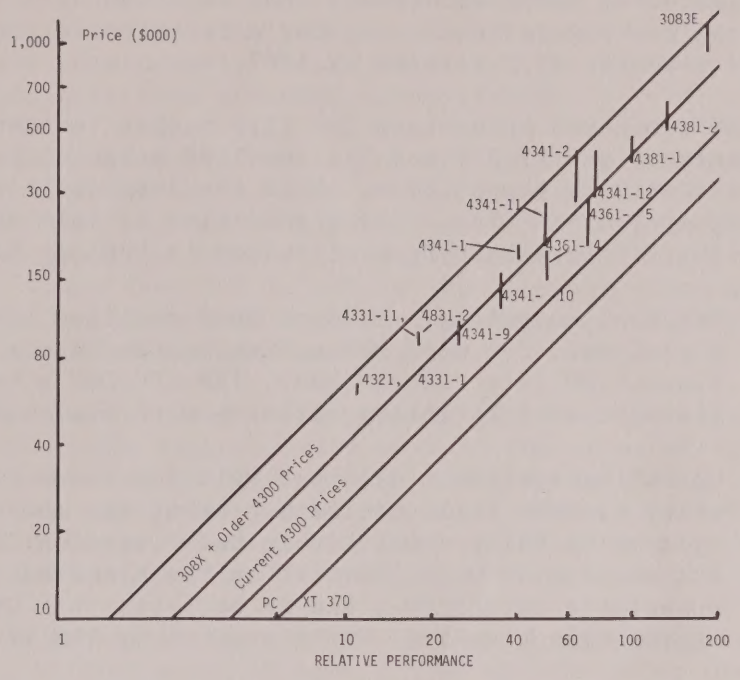
RELATIVE PERFORMANCE CURRENT IBM 370 COMPATIBLE SMALL AND MEDIUM SYSTEMS
(Copyright 1983 -- International Data Corporation)

Notes: Both axes use identical logarithmic scales, and thus express a linear relation between coordinates. Points that are low and to the right have the best price/performance ratios. The individual lines show a CPU price range, depending on memory size.

IDC's relative performance ratings are based upon manufacturer claims of system performance. IDC does not test machine performance and can make no claims to the accuracy of any individual claim. System performance can vary significantly depending upon application and workload.



VM usage in the 4300 world

The choice of VM for the IBM PC is just the latest evidence that VM is becoming more important to IBM's operating system strategy. IBM is not pushing MVS into the small system market, and it is making a slow push away from DOS/-VSE. Its Small System Executive (SSX), an easy to use version of DOS, has not been widely adopted, although it is too early to write it off. SSX should appeal to some first-time 4300 users, such as those moving from a S/34 or S/3.

Research by IDC's Software and Services group shows that VM is installed on some 25% of 4300 class systems, compared to about 60% with DOS. VM penetration of the 370-type base has been rising steadily since 1979 when the 4300s were introduced; the XT 370 PC can only increase the speed of this movement.

The problem with VM is the same as its strength; it is interactive, while DOS is primarily batch. But because VM almost always supports at least one other operating system as a guest, a coexistence between VM and DOS has developed, sometimes as a stepping-stone to MVS, sometimes not. The DOS base will remain substantial unless IBM significantly improves VM batch capabilities.

In an attempt to move some DOS users to MVS, IBM has decided to sell University Computing's DOS-to-MVS conversion package known as UCC-2. This is IBM's second major software OEM agreement this year, the other being its decision to sell Artificial Intelligence's Intellect. Although some large 4300 users are making the switch to MVS, current versions of that operating system remain too complicated and require too much memory for many small 4331-type users.

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Targeting the scientific market

International Data Corporation (publisher of EDP/IR) estimates that the scientific and engineering market accounted for 19% of the $4.1 billion 1982 U.S. personal computer market. And although this share will fall over time, the engineering personal computer market should grow at a healthy 25% annual rate, reaching $2.2 billion by 1987.

IBM's renewed enthusiasm for this market (evidenced by the scientific performance of the XT 370 and its new 5080 graphics terminal) symbolizes the overall increase in competition. With the introduction of new gear from IBM, DEC, Prime, Apollo, and Sun, it's a good time to take stock of this market, which has always been a harbinger of future technology trends. Among the key areas:

- Personal computing. Vendors have realized that engineers also have a real need for word processing, spreadsheets, and calendar functions. HP (via context MBA), IBM (PC DOS alternatives), and Apollo (integrated proprietary software with windows) have met this need.

- Operating systems. Although Unix continues to gain momentum, proprietary systems still dominate. Among the above, only tiny Sun Microsystems is fully committed to Unix (version III), but DEC is offering its version of Unix (Ultrix) on the MicroVax, Apollo is becoming increasingly supportive, and HP believes that Unix is the inevitable engineering standard. Unix support by IBM is expected soon.

- Hardware. IBM says its PC XT 370 (with two 68000s and Intel 8087 floating point unit) offers twice the performance of the 4331 in scientific environments (for about 15% of the price). DEC's $10,000 MicroVax is said to have one-third the power of the 780. Apollo has gone to a proprietary TTL CPU in its new high end systems which it says rivals Vax 780 performance. Sun is sticking with Motorola and is concentrating on workstations priced at less than $20,000.

- Competition. DEC's MicroVax is not really a direct response to the workstations; it is essentially a scaled-down mini and a price cut. DEC's Vax station 100 is perhaps a more direct competitor. DEC, Apollo, and Sun all noted that they haven't seen much of HP's 32-bit 9000 series in recent bids. IBM's 5080 graphics display hooks up to 370-type hosts, competing with companies like Tektronix. Prime (the PW150) and DEC (the VT241) also have new graphic terminals.

Apollo continues to demonstrate productive R&D spending and a knack for staying a step ahead of its major competitors. Although some question its decision to build its own CPUs, its mandate to continue to double price/performance every 18 to 24 months should keep the competition thinking. Perhaps more interesting has been its strong emphasis on software. In less than a year, Apollo built its own fully-integrated, windowed personal computing package, and its new engineering management programs move the company into the area of sophisticated software support tools and data bases.

Because engineers consume lots of system resources and need advanced capabilities, the scientific workstation market has a bright future and will continue to take business away from existing timesharing systems. Penetration levels are low, and thus the market can easily accommodate today's players.

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DEC GOES ON DEFENSE AT STOCKHOLDER MEETING

(The following notes are based on Nov. 3 remarks by Digital Equipment president Ken Olsen at the company's annual stockholder meeting held in Boston)

PC update. DEC says it shipped 19,000 PCs -- Rainbows, Pro 350s, and Decmates -- in last quarter (ending Oct. 2). Apparently Decmate and Rainbow shipments are about equal, while Pros are considerably less. Decmates are about on schedule; the other two systems have been somewhat disappointing.

Olsen says that DEC's planners are still bullish on the existing PCs and that production runs are not being cut back. Part of the problem is that software houses have taken an IBM first approach, delaying work on DEC systems, a problem that got compounded when DEC introduced three PCs at once. As for distribution, Olsen said several times that DEC is not in the consumer computing business, and he said that personally he didn't think that extensive TV and other advertising was a good use of resources for DEC.

On its fiscal woes. Olsen was honest enough to say that the recession wasn't the problem, administration was. The biggest holes were in the order entry system where many procedures are being changed as DEC tries to implement "expert system" technology. Less than expected PC shipments and a slowdown in Vax shipments because of disk drive problems added to the difficulties. Since DEC expects to resume growth shortly, no significant layoffs are anticipated.

Vax notes. Olsen confirmed that the big Vax will be announced before year's end and said that the company is very proud of what's coming. He noted that the product is late because it uses a lot of new technology (complex gate arrays and pipelining) and it is the first system DEC has ever built that could not be kept in one person's head. He calls it a "mainframe by all definitions"; no indications of performance were given.

Orders for current Vax's are above last year's, although disk manufacturing problems have slowed shipments. Since the disk problem has been solved, DEC expects to catch up on Vax deliveries soon. Some 600 Vax All-In-One office systems have been shipped (mostly as software add-ons), more than anticipated.

Trilogy. DEC bought 9% of Trilogy for three main reasons; its CAD tools, its wafer scale chips, and its on-chip redundancy. The company has "no interest in" and is precluded from building IBM-compatible systems. Olsen said that Trilogy wafers may become part of Vax systems in about two to three years. He noted that DEC was very willing to gamble $26 million on Trilogy but it is not counting on it. In-house Vax development work continues as planned.

New products. A VT100 replacement family (the VT 220, 240, and 241) has been announced, featuring smaller packaging and improved graphics. Also coming is a one-board micro Vax which Olsen says will again establish DEC as the small systems hardware leader. To meet strong demand, DEC has increased Micro PDP-11 production runs several times. DEC's videodisk system (Ivis) and scientific workstation (Vaxstation 100) have begun to be shipped.

Miscellany. DEC says it really didn't have any choice but to dump its system 10 and 20 follow-on effort. The project would have taken at least two more years, and the resources were needed by the Vax team. DEC knows it must support Unix, but says its customers know VMS is better and most won't change. S&P dropped DEC's rating from AAA to AA.

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• IBM DUMPS JOSEPHSON JUNCTION EFFORTS. Almost 20 years of expensive research has apparently led to a dead end. Ultimately, the use of this cryogenic technology proved too expensive and complicated, and its promised benefits can be achieved more easily through other means, such as Gallium Arsenide. All pilot production has been suspended, and scientists are being reassigned; a small staff will be retained to monitor Josephson technology developments.

• FRENCH GOVERNMENT REDUCES STAKE IN OLIVETTI. In a move that will make it much easier for Olivetti to work with a U.S. or Japanese partner, the French government has agreed to reduce its holdings from 33% to 10% of the Italian Office Equipment dealer. Olivetti is known to be actively seeking a U.S. partner, but potential partners have been scared off by the high stake of a socialist government. AT&T is the most frequently mentioned U.S. possibility.

• IBM PC JR. BEING MADE BY TELEDYNE. Going one step beyond the original PC which used non-IBM components, the entire manufacturing of the PC Jr. is being farmed out to Teledyne, a supplier of military and industrial equipment. Teledyne will assume the role of final assemblage after contracting with suppliers of various system components.

• DATA GENERAL TO SUPPORT IBM'S DCA/DIA. Just as most of the industry offers some type of IBM SNA support, expect the same vendors to conform to IBM's Document Content and Document Interchange Architectures (DCA/DIA). In October, Wang announced similar intentions. DG also announced support for the Federal Government Department of Navy Document Interchange Facility (DIF), which has a chance of becoming widespread within the federal government.

• XEROX COMPUTER SERVICES TO RESELL 4300s. The services firm is offering an IBM 4321 as a turnkey system with "fully integrated manufacturing, distribution, and financial applications for $250,000 for a minimally configured system. XCS offers similar software on a $150,000 Vax 730 system.

• NATIONAL SEMICONDUCTOR CLAIMS FIRST 32-BIT ONE MIPS MICROPROCESSOR. Having missed out on most of the 16-bit microprocessor action, National Semi hopes to make a comeback in the 32-bit realm. The company claims that its 6MHz 32032 (scheduled for volume production in April) exceeds one MIPS, and that 10MHz versions and faster will follow soon. It also boasts a true 32-bit architecture -- registers, ALU, data paths, and displacements.

• INTERLINK CLAIMS MVS/DECNET BRIDGE. Interlink Computer Sciences (Fremont, CA) claims that for the first time DECnet users can retrieve information (down to the record level) from IBM MVS data bases without needing to learn IBM procedures. The product consists of both Interlink hardware (a 3711 front end processor) and Interlink software at the IBM host. Prices start at $98,500, and shipments begin in January 1984.

• SPERRY TO OFFER DEDICATED MAPPER SYSTEMS. By putting its highly regarded Mapper software on a dedicated 1100 series machine, Sperry is targeting the decision support and information center markets, offering both ease of use and rapid application development. Base systems prices start at less than $250,000, about 50% less than any Mapper system previously available. First shipments of the so-called Mapper 10 System begin in April of 1984.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR NOV. 9, 1983 ● V/19, NO. 13 P.J. MCGOVERN, PUBLISHER

SUPERCOMPUTER MARKET CONTINUES TO SIMMER, BUT IS THERE ENOUGH DEMAND FOR ALL THE NEW PLAYERS?

If nothing else, supercomputers have become one of the most written about $200 million markets in the information processing industry. After years of being a one vendor (in Seymour Cray almost a one man) industry, the market is teeming with new players, projects, and funding.

Nationalism, the needs of the military, and fear of the Japanese have intensified the limelight, showcasing an untidy mix of organizations looking for money, politicians looking for votes, vendors looking for a market, and scientists looking for vastly improved price/performance capabilities.

Amidst calls for national action, confusion has reigned. Number-crunching supercomputers have somehow gotten tangled up in artificial intelligence debates, while the government has acted as if industry has some sort of moral obligation to build faster vector machines. Some key supercomputer areas:

- The scientific market. IBM has estimated that as much as 15% of its large system instructions are used for scientific tasks. Many of these could be vectorized and run on a supercomputer. Fujitsu and Hitachi are trying to open up the IBM part of the market. EDP/IR expects Amdahl to begin selling Fujitsu supercomputers in the U.S., but Amdahl has made no such annnouncement.

- Technology. Many scientists believe that the computational limits of Von Neumann machines can be improved by at best two orders of magnitude. Supercomputers will be at the forefront of new architecture development -- be they parallel, multiprocessor or dataflow systems.

- The military. One third of the supercomputers in the U.S. are used by the military, and defense scientists are eager for more power.

- Vendor integration. NEC has integrated an array processor in its high-end Acos 1000, and CDC's Cyberplus is a "multi-parallel processor" that works with CDC's 800 mainframes.

- Software. Compilers that vectorize existing Fortran code help overcome the inertia caused by heavy investment in existing software.

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In a market that sells less than 30 machines a year, the entrance of three new major players, Fujitsu, Hitachi, and NEC, poses some tough competitive problems. Unless there is a dramatic increase in the use of supercomputers, it will simply be impossible for five players to make any money. As ETA Systems supercomputer guru Neil Lincoln said at a recent Data Processing Management Association conference "Don't give us money; give us a market." Cray expects to install 16 machines in 1983, and 22 in 1984.

But it is clear that if the market is going to expand significantly, commerical customers will be the key. The government is always interested in faster machines, but its actual number of installations is not likely to increase dramatically. On the other hand, there are some 4,000 large mainframes in use around the world, and many of these sites have heavy calculation needs. According to the DOD, of the 50 or so supercomputers installed in the U.S., about 60% are in government, 30% in business and the remainder are in universities.

There are generally two ways that the commercial market can open up. The top down approach would have IBM introduce some type of vector processor, and make a serious sales effort to its large customers. Not only would this heighten industry awareness but it might trigger increased efforts to develop badly needed supercomputer software and peripherals. Depending upon Fujitsu/Amdahl's success in this area, IBM may be forced to take action.

The grass roots, long term solution is to increase the knowledge and interest in supercomputers at the university level. As long as only a handful of students have access to supercomputers, their use in real world problems will be limited. People use what they understand, and one cannot really learn about supercomputers by playing simulations on a Vax.

The high price of supercomputers has generally kept them out of most universities. There are proposals to build supercomputer timesharing networks along the lines of DOD's Arpanet; Britain and Japan have already begun such projects. But the main hope for increased usage will be falling costs, both for hardware and the necessary staff, support and high performance peripherals.

As the industry moves toward a multiprocessing approach to supercomputers, smaller, cheaper vector machines are becoming feasable, but are still a long way away. ETA is, however, now talking about a possible $1 million system. Improved interactive capability would also be a nice addition.

Technology issues

In the meantime, the race for gigaflops continues. Although software and customer support are very important parts of the market, ultimately it is pure speed that makes some projects possible and others not. Today's machines top out around peak speeds of 500 MFLOPS (millions of floating point operations per second) range. Best estimates are that these speeds will be increased by a factor of 50 to 200 by the end of the decade.

Spokesman for both Cray and CDC/ETA indicated that at least thru 1990, they do not envison any radical changes in architecture. Although both recognize that multiprocessors will be used, this will not preclude the necessity of building each box to be as fast as possible. Given the lack of parallel operating system expertise, they agree that in this decade systems that use large numbers of processors won't be important except in special applications.

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SUPERCOMPUTER & SUPERCOMPUTER PROJECT COMPETITION

Organization	model	announcement or project start	availability	architecture	maximum performance (M FLOPS)	Maximum main memory size MB	Technology: Logic (gate delay)	Technology: main memory	No. paths (Total)	Input/Output: Max. data rate path (MB/sec)	Input/Output: max aggregate data rate(MB/sec)
Fujitsu	VP-200	July 1982	Nov. 1983	Vector IBM compatible	500	256	ECL	65K MOS static (55 ns)	32	3	900
Hitachi	S-810/20	Aug. 1982	Nov. 1983	Vector IBM compatible	630	256	ECL (350 ps)	16K MOS static (40 ns)	32	3	1,100
NEC	SX-2	April 1983	March 1985	vector	1,300	256	NA	64K MOS static	32	1.5	1,350
CRAY	1M	Aug. 1982	Sept. 1983	vector	250	32	ECL (SSI, .7ns)	16K MOS (70 ns)	19	100	550
	X-MP	Aug. 1982	June 1983	vector multi-processor	630	32	ECL (.5-1ns)	4K ECL (25 ns)	19	1,000	1,550
	2	none yet	mid 1984	vector multi-processor	1,000	NA	ECL	MOS	NA	NA	NA
	3	none yet	1985/86	vector multi-processor	NA	NA	ECL GaAs	MOS	NA	NA	NA
CDC	205	June 1981	Feb. 1982	vector	400	64	ECL (700 ps)	MOS (45 ns)	16	25	400
	2XX	none yet	1986/87	vector multi-processor	1,200 2,000	256	CMOS (0.5-1ns)	MOS	16	50 - 60	1,000
Denelcor	HEP-2	May 1983	1985/86	scalar	1,000	2,000	NA	NA	NA	NA	NA
Japan (MITI Project)		(Jan. 1981)	1989	vector multi-processor	10,000	1,000	JJ/GaAs (10-30 ps)	16K GaAs (10 ns)	NA	NA	1,500
France (Min. de la Defense DRET Project)	ISIS	(1980)	1986/87	vector	200	256	NA	NA	NA	NA	1,200
	MARIANNE	(1980)	NA	multi-	NA	NA	NA	NA	NA	NA	NA
	Not Named Yet	not yet started (will combine MARIANNE & ISIS)		vector multi-processor	NA	NA	NA	NA	NA	NA	NA

SOURCE: NATIONAL BUREAU OF STANDARDS

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A clear shift has been towards MOS memory. As machines get faster, I/O bottlenecks have become significant. Consequently, some observers believe that in many applications it will be necessary to keep virtually the whole data base in main semiconductor memory. Supercomputer vendors and consultants talk about systems that need a billion words of main storage, but this can't be done in bipolar which would require too many parts and give off too much heat.

One would expect that in their pursuit of speed, supercomputer vendors would be leaders in advanced packaging, but this hasn't been the case. Supercomputer circuitry is not very different from many general purpose systems. In both cases, scalar speeds will level off unless chips such as Josephson Junction, Gallium-Arsenide, or HEMT (High Electron Mobility Transistor) can be used.

Interest in Josephson Junction (JJ) technology has faded, although the Japanese are still investigating it, and a new start-up Hypres is trying to apply the technology (see back page). IBM and AT&T have sharply cut back their JJ efforts, as the easier to use Gallium Arsenide technology has narrowed the potential performance improvements. Fujitsu is working with both GaAS and HEMT.

Supercomputer circuitry innovation is limited by economics. U.S. chip makers are not particularly interested in working with supercomputer manufacturers because the order volumes are so small. At the same time, CAD costs are soaring. CDC/ETA has a total of some six Cyber 175 and 205s just for design, and the needs are growing. CAD capabilities are struggling to keep pace with VLSI development, which is why Trilogy has done so much custom CAD work. In fact, VLSI design is becoming a hot application for supercomputers, and Cray has spun out a group (Circuit Tools, Inc.) to address this market.

Software

One of the key obstacles to using supercomputers in many environments is that their use threatens to obsolete years worth of Fortran programs. Although both CDC and Cray offer compilers that automatically vectorize Fortran loops, relatively little research has been done on general vector techniques and multiprocessing algorithms. Many applications that would clearly run faster using a vector language are written in Fortran because of hardware dictates.

It is perhaps ironic that the Japanese are aggressively addressing this software issue. Fujitsu's VP 100 and 200 are designed to work in an IBM environment. The company claims that the software is an extension of its current MVS-like OSIV/F4, and that it operates like a mainframe requiring no special operator training or cooling. Hitachi is taking a similar approach.

Perhaps more importantly, Fujitsu is offering what it calls a highly advanced compiler (Fortran 77/VP) that can vectorize standard Fortran 77 and Fortran IV programs. Although such compilers are not new, Fujitsu claims a breakthrough in its system's ability to also significantly speed up IF statements which it says has proved impossible with conventional methods. All JCL, source programs and data sets are compatible with OSIV/F4.

Since supercomputer sales will often follow good software, Fujitsu's IBM-oriented approach makes a lot of sense. Academic studies indicate that somewhere between 20% and 80% of all Fortran code is theoretically vectorizable. Procedures such as table look-up, formatting, and recursion are not readily vectorizable, so significant scalar capability will always be required.

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PRIMER ON SUPERCOMPUTERS

Supercomputers ... scalar computers ... array processors ... vector processors ... pipelining ... parallel computers ... multiprocessing, etc. It's no wonder that many are confused by today's terminology. In fact, the above terms do largely describe different things, and understanding the terms is a key to untangling the fifth generation/supercomputer jumble. Some definitions:

Supercomputer -- must have very high speed vector and scalar processors. The highest speeds are for the vector operations useful in scientific calculations, but since a system is only as fast as its slowest part, fast scalar speeds are also needed and have been a key to Cray's success. Examples: Cray, CDC 205.

Scalar computer -- Operates on individual data elements under central control, also called a Single Instuction and Single Data stream (SISD) or Control Flow system. Typified by the Von Neumann architecture used in the general purpose systems of the last 20 years. Scalar computers may or may not be pipelined, and may or may not use a limited amount of multiprocessing .

Vector processor -- a special purpose computer that has virtually a complete set of instructions that can operate on numerical vectors. (A vector is an array of data with a fixed increment or "stride" between successive elements.) Also called Single Instruction Multiple Data stream (SIMD) systems. Examples: machines from Floating Point Systems and Star Technologies.

Array processor -- one of the more confusing terms, used to indicate both a single processor operating on arrays of data, as well as arrays of processors that operate together. In the former, is synonymous with vector processor, in the latter often used to mean parallel processors.

Pipelining -- An instruction staging mechanism used in both vector and scalar systems whereby different steps in the preparation and exectuion of an instructions are done simultaneously. Examples: most large general purpose systems and supercomputers.

Parallel computers -- use multiple processing elements to work on a single task, also called Multiple Instruction Multiple Data (MIMD). Except in a few specialized applications, these machines have been largely academic exercizes thus far. The main problem with these machines is maintaining coordination and control. They may or may not be pipelined. Examples: Goodyear MPP, Illiac IV.

Multiprocessing -- uses two or more procesors to work on a single job but work is done under a central operating system control. Example IBM 3081.

TYPICAL SUPERCOMPUTER APPLICATIONS IN GOVT. AND BUSINESS

Government	Business
Nuclear weapons design	Seismic data processing
Cryptographic analysis	Engine combustion modeling
Aerodynamic modeling	VLSI design
Weather forecasting	Structural analysis
Fusion research	Nuclear reactor optimization
Oceanographic research	Chemical process modeling
Satellite image processing	Movie images and animation
Fundamental science research	Aerodynamic modeling

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CURRENT MAJOR SUPERCOMPUTER PROJECTS

Organization	Project description
U.S. Department of Defense	Very High Speed Integrated Circuit.
M.I.T	VLSI data flow machines.
Univ. of Illinois	Automated parallelizing of Fortran, and Cedar, a parallel/Von Neumann computer.
Univ. of Texas	Texas Reconfiguarble Array Computer (TRAC) and necessary Pascal compiler.
Purdue Univ.	Blue Chip, lots of processors on a wafer, and PASM, a partionable array.
Univ. North Carolina	A binary tree computer programmed in FFP (Formal Funcitoning Program), considered a highly original project.
New York Univ.	The Ultracomputer, highly parallel system with a large shared memory.
Denelcor	HEP (Heterogenous Element Processor), a commercial product, a parallel system with some Von Neumann features.
ICL	VLSI vector processor to go with Perq workstations.
Univ. College (London)	Clip-4, an image processor.
Inmos	Several hundred processors on a wafer, also working on parallel languages.
Centre d'etudes et de Rech. (France)	Parallel languages and compiler, now working on hardware as well.
Univ. of Frankfurt (Germany)	Data flow machnines.
Technical Univ. of W. Berlin	General purpose and vector parallel systems (Starlet and MAC).
Nippon Telephone and Telegraph	Parallel vector and list processors.

Generally attempts to increase speeds fall into three camps: faster circuits, extensive vector and scalar pipelining, and parallel systems. But most observers agree that if machines 1000 times faster than today's are to be built, some type of parallel hardware must be used. Unfortunately, issues of coordinating and synchronizing parallel machines have proved formidable, and progress has been slow and uneven.

The idea of moving away from Von Neumann type processors to a parallel processing approach is about 20 years old, and since only a few such systems have emerged -- the Burroughs-built Illiac IV, Goodyear's Massively Parallel Computer, and a few others -- there is reason to take a "show me" attitude. Nevertheless, as the table above shows, research into parallel systems continues to grow, with at least 50 to 75 such groups around the world. Microprocessors and VLSI continue to make parallel architectures more attractive.

Not surprisingly, most of the action is in the universities. Computer system vendors clearly are reluctant to aggressively seek new architectures that would probably be incompatible with their present systems. Although EDP/IR expects that the major system vendors will increasingly incorporate vector processing capabilities, they will do it in an evolutionary manner.

Not mentioned here is the Japanese Fifth Generation project. Although that effort is counting on tremendous increases in processing power, its main emphasis is on artificial intelligence, a separate software-oriented issue.

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THE NEC/HONEYWELL PACT. A MILESTONE THAT WAS INEVITABLE

Because of its twenty year history of dealings with Nippon Electric Company (NEC), Honeywell has always been the most likely U.S. mainframer to OEM a Japanese machine. NEC's Acos operating system is a derivative of Honeywell's GCOS and the two are still quite similar. Both companies use Current Mode Logic (CML), a variant of ECL, and have a history of technological exchange.

Thus Honeywell's decision to sell NEC's high end S-1000 (formerly known as the Acos 1000) is not likely to signal a major shift toward OEMed Japanese CPUs. Mitsubishi does manufacture Sperry System 80s, but no Japanese vendor specializes in Sperry, Burroughs, or CDC-like large systems. Since key Japanese mainframers Fujitsu and Hitachi are committed to the IBM path, no similar U.S./Japanese pact appears imminent; the scale economies just aren't there.

Nevertheless, the announcement shows how much things have changed over the last two decades. In 1962, NEC began selling Honeywell mainframes in Japan using Honeywell software. Over time, it began to build its own hardware, and its operating system ACOS slowly evolved to meet the needs of the Japanese market. Today the S-1000 is believed to be 40% faster than the DPS 88, and it has an integrated array processor for even faster scientific performance. The pupil has clearly outshined the teacher.

But issues of national pride aside, the move makes sense. At a time of rising mainframe development costs and less than heady earnings, Honeywell would find it difficult to bring out machines larger than its current DPS 88s in the near future. Honeywell customers can now be more certain that future high end machines will follow. For NEC, the tie may allow them to enjoy manufacturing scale economies closer to those of its key competitors -- Fujitsu and Hitachi.

Although the Honeywell/NEC competition at General Electric Information Services Company (Geisco) may have brought the issue to a head, Honeywell probably could have withstood a loss in that battle. Before the recent deal, Honeywell and NEC had agreed that NEC would not sell its machines to GCOS environments. Geisco was an exception because it uses its own Mark III operating system.

The new agreement also avoids NEC/Honeywell overlap. Essentially, Honeywell has exclusive worldwide rights just about everywhere besides Japan. NEC will not sell machines into any GCOS environments. Honeywell will work things out with Honeywell Bull once the final pact is reached with NEC. Honeywell has the right to build NEC 1000 or any follow-on, although it is doubtful whether it will exercise these options. The limited size of the two companies' high end installed bases does not seem to justify two manufacturing operations.

Many parts of the agreement have yet to be ironed out, and the final terms aren't expected to be signed until the first quarter of 1984. Honeywell would not comment on two key issues -- CPU price and peripheral suppoort -- noting that GCOS 8 support for the S-1000 will not be available until the second half of 1985 (nicely coinciding with expected deliveries of IBM's Sierra series).

The fate of Honeywell's large system group in Phoenix remains uncertain, although Honeywell claims the recent layoffs of 500 workers had nothing to do with the NEC deal. Last March, Honeywell changed the group's name from the Large Information System Division to the Large Computer Products Division. EDP/IR expects the Honeywell group to become increasingly software-oriented.

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• SOFTWARE ALSO PART OF HITACHI/IBM SETTLEMENT. Although the details of the agreement have not been made public, IBM and Hitachi have apparently reached an important software understanding. Both Fujitsu's and Hitachi's operating system software borrow heavily from IBM's MVS, but IBM has never received any kind of compensation. Hitachi has now agreed that in cases where Hitachi software closely resembles IBM software, a reasonable fee will be paid to IBM. The provisions were part of several "side agreements" that were not specified in the official technology theft suit settlement.

One of the ways that Hitachi and Fujitsu have managed to compete successfully with IBM in Japan is by adding software tailored to the Japanese market, especially Kanji handling capabilities. Since IBM does not allow anyone to modify its licensed programs for resale purposes, there was concern that if Hitachi and Fujitsu had to license IBM's MVS and couldn't modify it, their ability to compete in the Japanese market would be significantly diminished.

The compromise that seems to have been worked out allows Hitachi to call its operating system "Hitachi software." It pays a fee to IBM, but not a program license fee; it is therefore apparently free to make whatever modifications it chooses. A similar agreement with Fujitsu is also believed to be in the works. The whole issue is complicated by the fact that Japan does not have a clear software copyright policy.

• TANDEM ADDS HIGH END SYSTEM. Tandem claims its first 32-bit system, the Nonstop TXP, is two to three times faster than the popular Nonstop II. Tandem needed the larger machine both to fend off competition and to meet the needs of high volume transaction systems such as retail banking where volumes can reach several hundred transactions per second. Fully compatible with the NonStop II, first shipments begin in November. A TXP with two 2MB CPUs, two 128MB disks, a 45 ips tape drive, console and software lists for $328,550.

• STC INTRODUCES IBM 3800 COMPETITOR. The new STC 6100 laser printer is positioned below IBM's 3800, which is twice as fast but much more expensive. The 6100, which is being manufactured for STC by Siemens, prints 100 pages per minute and costs $195,000. First shipments are in January of 1984. With its volume shipments of 3380-type disk, its new high capacity tape drive, and its new optical disk system, STC may be getting back on the growth track for 1984.

• DEC UNVEILS MICRO VAX LINE. Billed as the first in a line of microprocessor-based Vax systems, the Micro Vax 1 contains all logic and memory on just three boards, and runs a subset of the VMS instruction set. It will also run Ultrix, Dec's implementation of Berkely 4.2 Unix. Like the company's LSI-11 and PDP-11 systems, the Micro-Vax uses Q-bus and is packaged quite similarly to the PDP-11. The system supports from one to four users and has about one-third the power of the /780. With an OEM price of $10,000 including a 10MB winchester, the Micro Vax is priced well below the previous low end Vax 730.

• START-UP TO MARKET EQUIPMENT WITH SUPERCONDUCTING CIRCUITS. HYPRES, Inc. intends to build signal processing equipment using superconducting circuits. Located in Elmsford, NY, Hypres was founded by Dr. Sadeg M. Faris, formerly of IBM's Watson Research Lab. The company will investigate both Josephson Junction and Quiteron chips. IBM has sharply cut back its own Josephson efforts.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR OCT. 20, 1983 ● V/19, NO. 12 P.J. MCGOVERN, PUBLISHER

WANG OPTS FOR OPEN ARCHITECTURE AND BUILDS IBM LINKS, AS PCs GAIN IN STATURE

IBM's Document Content and Interchange Architectures are only a few months old, but already IBM's key office competitor has announced the end of its "closed company" office automation approach.

As part of a gaggle of October product introductions, Wang Laboratories has said that it will support IBM's DCA/DIA and that it will also make its own word and data processing specifications available to anyone who wants them.

Wang is merely following the requirements of the market. As personal computers and office systems proliferate, demand for inter-system compatibility is rising so fast that vendors are finally deciding that successful compatibility efforts will create more business than they will lose.

Thus a CPT or an NBI will, theoretically, be able to make its output Wang compatible, and a Wang customer will be able to revise documents created on an IBM system. Communications capabilities will go beyond today's terminal emulation and into the higher levels of layered architectures such as SNA.

Give Wang credit for making changes before confusion hit. Thanks to its personal computer and strong VS and OIS shipments fiscal 1983 revenues were up 33% over 1982, reaching $1.5 billion. Among the key developments at Wang:

- Personal computers. Wang expects to ship some 75,000 PCs in the next 12 months (approximately $350 million). About 25% of all VS workstations being shipped are PCs and this percentage is rising.

- Positioning vs IBM. In addition to eventual DCA/DIA support, Wang will offer its own links to IBM systems called the Information Distribution System (IDS). It will also offer Unix System V.

- Manufacturing. Wang continues to buy all of its semiconductors and disk drives from outside manufacturers, the only firm in the billion dollar club to pursue this strategy.

- Image processing. Although image scanners are not new, Wang claims to be the first to fully integrate one into an information system.

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IBM vs Wang in the office

The much publicized Australian Department of Social Security (DSS) contract is perhaps the best indication of how Wang is increasingly going head to head with IBM in markets outside the realm of text processing. The results suggest that IBM might need new products for the office more badly than some imagine.

In that bid, Wang was awarded a contract for some 400 VS systems handling roughly 7,000 workstations to be installed between now and 1987 in a contract worth some $70 million. The VS systems went up against IBM 8100s. The ironic part of the story is that IBM also lost the mainframe part of the bid to Amdahl and the peripheral contract to Storage Technology, creating a large IBM-based system where IBM provides little except software.

Contracts such as this demonstrate that in many environments the lines between office automation and distributed processing have largely vanished. And since these implementations demand extensive end user involvement in the procurement process, IBM cannot rely on its MIS entrenchment to carry the day.

To some extent, EDP/IR has been surprised by just how few major office automation contracts have been announced. When Data General made a big deal about its $40 million E.F. Hutton win, it in effect threw down the gauntlet to competitors to match the success. Only IBM can really afford to stay above that type of fray, but big contract announcements have been relatively few.

Part of the reason for the sluggishness has been that IBM has been telling its customers to wait, that improvements to its current line-up will be announced soon. When IBM plays its hand, this market should take off. IDC, publisher of EDP/IR, estimates that the market for multifunction office systems will grow at 116% per year through 1987, reaching $3.5 billion.

PCs forcing the action

Integrated personal computers are also a key part of the process. Wang expects that over the next year or two the share of its VS workstations that are personal computers will rise to about 50%. Although IBM has been building PC links to its smaller systems, its mid-range system customers continue to rely primarily on terminals. The balance between the terminals and PCs linked to a larger system will, of course, vary greatly among different user groups and applications. Some 50% of Wang's PCs are sold as Wang workstations, the rest are standalone with 20% going through Independent Sales Organizations.

Thus far, Wang has decided not to implement its VS architecture into a workstation. A Wang executive indicated that although there is a market for such a product, it fears that full-blown mini software on a workstation imposes undesirable support and maintenance costs. He speculated that DG and Honeywell will find it hard to profitably service their products. Given the complexity of the 370 software, IBM must have similar concerns for its new VM desktop.

He suggested that the Wang approach would probably be to offer a slimmed down version of the VS architecture, but conceded that deciding which features to put in and which to take out would not be easy. A modular approach may prove to be the best compromise. A proprietary chip is not deemed necessary; the VS architecture could be implemented on a merchant chip, he noted. Wang does not manufacture semiconductors, although it does a lot of custom design.

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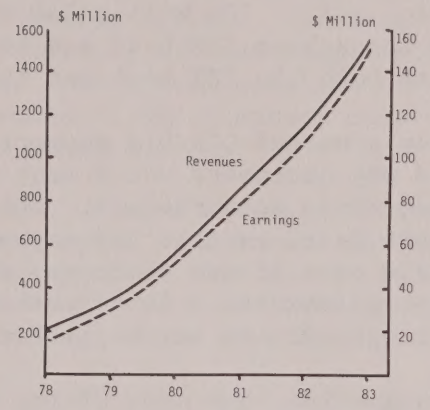
The left hand scale indicates revenues and the right hand side is for earnings. Since the two scales are exactly proportional, the chart shows that Wang's earnings and revenues have stayed in constant proportion over the 1978-83 period. Wang generates $1 in profits for every $10 in revenue. In 1982, IBM brought in $1 of profit for every $7.8 revenues. Wang's 1983 fiscal year ended June 30, 1983. Fiscal 1984 also looks strong as the company enjoys a backlog of $879 million, up 38% over last year. With the falloff at DEC and STC, no major firm in the industry can match Wang's growth record.

WANG REVENUE AND EARNINGS GROWTH
1978-1983

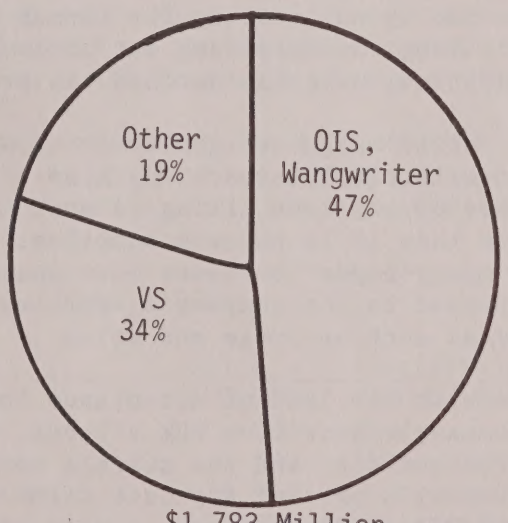


Wang's view of the market and its product positioning

As a leader in office automation, it is not surprising that Wang's systems have evolved along with the market. A few years ago, the company had three distinct product lines: the 2200 series aimed at small businesses and other first time users; the OIS line that targeted the text processing market; and the VS systems, generally aimed at distributed processing applications.

As the market has required ever-rising levels of product integration, the Wang product line has begun to overlap, especially the VS and OIS lines. The VS systems have added powerful text processing, and the OIS products have been given more computing capability. A battle for resources has inevitably developed, and it appears that the VS line is winning.

WANG'S FISCAL 1983 BOOKINGS



The OIS, however, continues to be Wang's biggest revenue producer. Over the last year Wang has protected its clustered word processing turf by coming out with smaller OIS systems using less expensive terminals that are upward compatible, and overall OIS sales remain strong. Wang continues to control about 50% of the clustered word processing marketplace. Sales of the 2200 systems have, however, levelled off.

The installed base of VS workstations is now 88,000 (on 8,000 systems), compared to some 160,000 on the OIS and other WP systems, and 70,000 on the 2200. Wang's breakout for fiscal 1983 bookings are shown in the chart opposite. The "other" category includes the 2200, the PC and various communication products. Bookings represent orders received during Wang's fiscal 1983 which ends June 30.

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DCA/DIA vs Wang IDS

Although Wang has said that it will support IBM's document specifications, it is also pushing a Wang-based alternative, the Information Distribution System (IDS). IDS will allow file exchanges (including WP text) between VS CPUs through an IBM host and between VS and IBM systems. Software programs sit at both the IBM host and the VS system.

The promised DCA/DIA support will of course allow similar exchanges. When asked why customers would want to go with the Wang format, a spokesman suggested three main reasons: IDS is easier to implement; it will be able to support features that IBM may not offer, such as voice and image data and certain ease of use features; and IDS will be on the market before DCA/DIA is fully implemented. Those customers that expect to go primarily with Wang for mid-range systems may be better off with IDS. Mixed shops probably wouldn't.

Wang notes that many of its VS users are already making significant use of SNA and 3270, and the company is thus getting a lot of questions about DCA/DIA. The same spokesman commented that Wang expects that many Fortune 1000 companies will insist that office systems support DCA/DIA, and many in fact will standardize on it. Thus, Wang's early announcement of support is designed to send a message to its customers who must plan for multi-vendor networks now.

Wang takes wraps off WP formats

The other half of Wang's new openness is its decision to let others tie in to its systems. A $500 license agreement pertains to current WP specifications as well as future voice, image, data, and graphics information. The data falls under the labels of the Wang Word Processing System Communication Specification (WPS-CS) and the Wang Information Transfer Architecture (WITA). Negotiations with competitors for Wang specifications have already begun.

Although its considerable installed base (Wang estimates that more than one billion documents have been created on its systems) might be more easily protected by not sharing its format information, a policy of exclusivity will in the long run keep Wang out of some bids that require multiple systems. In addition, Wang has watched the protocol conversion industry rise up around it.

While Wang has submitted its WITA specs to various standards boards, it doesn't really expect any kind of endorsement. A spokesman noted that the purpose of any such filing is much more to influence the direction of the committee than it is to seek adoption. By being active in standards efforts, the company hopes to insure that whatever path is adopted will not be diametrically opposed to the company's approach. This is especially important in emerging areas such as image and voice.

With the lack of acceptance for Wangnet, the Tymshare fiasco, and the company's secretive PBX efforts, Wang has stubbed its toes on its networking arrangements, and the overall company direction is not clear. In fact, the company's present approach seems to be more a menu than a strategy. IDS, DCA/DIA, X.25, Wangnet, a wide area network arrangement with Bolt Beranek & Newman, and an equity position in U.S. Satellite Systems suggest little other than a desire to keep its options open without huge financial commitment. Wang has talked with every major PBX maker, but hasn't made any deals. The company believes multiple solutions will be needed to meet diverse market needs.

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Wang integrates image and text

Although products that can digitize an image and represent it on a screen in non-coded form have existed for several years, Wang is among the first to integrate such a product into a major data processing system. The Wang Professional Image Computer (PIC) can insert images into VS, OIS and MS/DOS documents which can then be manipulated, but not altered. The system consists of a Wang PC, a camera-like scanner (using a Texas Instrument's CCD scanning chip), a high resolution monitor and a thermal or laser printer.

Wang certainly earned a place on the frontiers of hype when a spokesman noted that "describing the PIC is a little like trying to describe the Sistine Chapel." Nevertheless, the PIC is an innovative product that blends in well with many parts of the Wang customer base, and Wang's 30-month development effort should pay off, but perhaps not until storage costs come down.

Wang says that its 10MB winchester can hold about 100 pages of images, but additional capacity is available on VS or OIS systems. Wang believes the PIC will prove especially popular once optical storage catches on. The scanner does not yield camera ready quality, but Wang says it is a "high quality image, usable for 80%-90% of the potential applications.

The idea for the project came from some of Wang's large insurance customers who wanted to integrate forms into written documents. Wang reports that there are already five outside firms developing applications for the PIC, and many units have been shipped to selected test markets. The company expects that it will ship considerably less than 10,000 units in 1984, but the product will gather momentum over the 1985-87 period.

Announcement roundup

Although the DCA/DIA support and the Wang PIC have grabbed most of the headlines, Wang also announced several other key future products. The three most important are: a fully relational data base managment system (complete with fourth generation application development tools that Wang claims will run on the entire VS family); support of Unix System V on the VS line; and WP Plus, an improved text editor that keeps up with the company's WP competitors.

The Unix capability is becoming increasingly necessary for government bids, and virtually all of the major mini vendors have at least announced plans for some type of Unix support. Unix will run on any VS system, and VS and Unix can run on one system and be accessed by the same workstation.

DELIVERY AND PRICES FOR NEW WANG PRODUCTS

Product	Price	Availability
Information Distribution System	$59,000	March 1984
Wang Word Processing Specs (WPS-CS)	500	Now
Wang Information Transfer Architecture (WITA)	500	June 1984
Wang Professional Image Computer (basic version)	14,965	February 1984
Wang VS Relational DBMS (PACE)	37,000	June 1984
Wang WP Plus (improved word processing)	2,000	June 1984
VS support of Unix System V	NA	March 1985
Cobol for Wang PC	1,750	December 1983
DEC VT100 emulation for Wang PC	200	January 1984

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About DCA/DIA

Expect the Wang announcement to be part of a steady stream of vendor statements indicating support for IBM's Document Content and Interchange Architectures (DCA/DIA). Just as most major vendor offers some level of SNA support, homage to DCA/DIA will have to be paid. And like SNA, DCA/DIA will be much more important to some vendors than others.

The publication of the DCA/DIA specifications is the best evidence yet that IBM is serious about extending an open architecture policy beyond the PC, where it has been so successful, into large multi-user systems. IBM has abandoned its one-time tight-lipped policies over SNA, and this cooperation is being extended to DCA/DIA. If DCA/DIA was intended only to solve IBM's in-house compatability problems, there would be no need to publish the specs.

IBM has adopted this major strategic change because it realizes that as information systems diversify, it will not be able to supply all things to all people. There will always be a demand for specialized products and services. Since SNA customers will demand multi-vendor support, IBM must cooperate if it wants to keep its existing customers happy and if it wants to be able to successfully sell SNA. A proprietary IBM approach would cause some customers to defect to alternatives such as the public packet nets and X.25.

As the industry moves toward an era of sophisticated networks, SNA looms as an increasingly important strategic product. This is somewhat ironic since SNA was originally designed primarily to make life easier for IBM. In the early 1970s, SNA was seen as a way to standardize communications access methods at a time when multiple methods had resulted in a chaotic user and maintenance situation. Only since the rise of office systems has SNA come to be seen as a way to glue diverse systems and applications into an integrated system.

EDP/IR thinks that once IBM implements DCA/DIA on a broad array of products, user implementation will proceed more quickly than it has with SNA. The problem with SNA is that it has never offered any one benefit that could overcome user inertia and investment in older communications architectures.

DCA/DIA has the clear selling point of being able to exchange documents between various IBM and non-IBM equipment. This is something end users can relate to and will in many cases insist upon. In fact, it seems likely that DCA/DIA may be the key to greatly increased SNA penetration.

Neverthess, DCA/DIA implementations will not become significant overnight. The Distributed Office Support System (Disoss) software which is necessary for DCA/DIA tasks is not presently installed in any significant numbers, and International Data Corp.'s IBM user survey results suggest that even by the end of next year less than 20% of 370/4300/30XX sites will have Disoss installed.

Disoss is the critical part of DCA/DIA services. It performs the actual manipulations that make it possible for a document created on one system to be transmitted in an editable form to a dissimilar machine. It is interesting to note that at this time at least, Disoss does not convert all documents into a single common format. In the case where sending and receiving devices are already compatible, it would not perform any transformations. Currently, only the Displaywriter, the 5520, and the 8100 have significant document interchange capability. Unfortunately, these are not particularly key products for IBM.

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EDP/IR expects the action to really heat up in the 1985-1987 period as IBM fully integrates the PC into its systems and introduces improved products in the shared logic integrated DP/WP arena. These products will coincide with increasing sales of minicomputer based office products from DEC, DG, HP and the like. Users of these non-IBM systems will also press for document interchange capability. In cases where there is a lot of interaction with an IBM host, DCA/DIA may prove a desirable standard.

The relation between DCA/DIA and SNA can best be described as complementary. SNA, as it exists today, is concerned with transport issues such as connectivity, maintenance, device support and diagnostics, while DCA/DIA is primarily concerned with application level services. An already well used analogy is that SNA act as the postman; DIA is the envelope; and DCA is the message. Since DCA/DIA/SNA act as a single layered architecture, changes can be made to one without effecting the others.

Although SNA is not particularly well suited for the peer-to-peer types of communications that DCA/DIA will allow, there is no question that DCA/DIA and SNA will coexist. Responsibilities for DCA/DIA development lie with IBM's Communications Products Division where SNA reigns, and many of the key DCA/DIA program managers come from the SNA development ranks.

The concepts behind DCA/DIA are really quite simple. Like SNA, DCA/DIA are not IBM program products, but rather are architectures that define common formats, protocols, and data structures that can be used on wide array of products working in an SNA network. The key parts of DCA and DIA are specified below.

- DIA -- Library, distribution and application services. Library services involve archiving and storage/retrieval. Distribution services are what the name suggests. DIA applications are primarily concerned with providing an interface for user-written programs that pertain to library and distribution services.

- DCA -- All text exists in either revisable or final form. DCA is primarily concerned with formatting specifications and deals with the issues of security and document integrity.

Hooks for voice and image data are also expected although the announced specifications don't address those issues. IBM does note that in the future "DCA can be extended to accomodate other information such as images, graphics, and audio without affecting DIA." Also in the overview of the published specs (IBM pub. # GC23-0765-0) IBM makes use of the term "office system node."

One decision IBM must regret is that it didn't implement DCA/DIA formats on the PC. Now IBM faces the task of somehow merging the Displaywriter and PC software so these two machines can work smoothly within a local network. That the PC was not included in the DCA/DIA plans corroborates IBM's frequent claim that it has been very surprised by the scope of the PCs success.

The basics of DCA/DIA have thus far only come out on the Displaywriter, the 5520, and the 8100. If IBM had wanted to, it could have included it on the PC, instead it chose to use Wordstar and to use different formatting codes. EDP/IR expects that IBM will address this problem on some future word processing release, but when IBM will begin to implement DCA/DIA on key products such as the S/36 and 4361 remains to be seen.

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• IBM ROLLS OUT NEW PCS, 8100, AND MORE. Showing that it can move fast when not encumbered by its installed base, IBM has brought out two new personal computers, both of which are aimed at its mainframe customers. Available in the second quarter of 1984, the PC XT/370 is an upgrade to the PC XT that uses three customized chips -- two Motorola 68000s and one Intel 8087 -- to run just about the entire VM instruction set. IBM is offering the VM software for a one-time bargain license fee of $1,000. The 3270 PC combines 3270 functionality -- attaching to a 3274 controller -- with MS/DOS capabilities and makes use of extensive windowing; it becomes available in the first quarter of 1984.

Also introduced was a new top-of-the-line 8100. Using a dyadic processor architecture, the 8150 is 2.4X faster, supports twice as many workstations, and has three times the memory (up to 6MB) as the 8140C, and like the 8130B announced in June, it features significant new technology that implies renewed IBM commitment to the product. The announcement puts lots of emphasis on high availability. The 8150 will be available second quarter 1984. EDP/IR suspects that the 8100s intended rebirth will center around its ability to act as a server for PC workstations. IBM also announced that the 3084 will support up to 96MB, and introduced a new ergonomic terminal for the Series/1.

• IBM WINS BIG IN HITACHI TECHNOLOGY THEFT SUIT. IBM remains the king of the courtroom. After a lot of early talk that IBM might regret ever having brought the charges, the giant has scored an impressive legal and PR triumph. As part of a complex settlement, IBM will have the right to inspect any new Hitachi systems built between now and October 1 1988. Included will be the right to see relevant manuals and documentation. If IBM believes any Hitachi product contains stolen IBM technology, an arbitration panel will review the claim and its decision will be final. In addition, Hitachi has to pay all of IBM's legal fees. All that remains now is IBM's dispute with National Advanced Systems which sells Hitachi CPUs.

• TYMSHARE TO TARGET DEC SYSTEM 20 BASE. Ever since Digital Equipment pulled the plug on its mainframe development effort, a large timesharing user base has been up for grabs. Many DEC System 10 and 20 users do not want to go through the battle of migrating from their 36-bit systems to the 32-bit Vax, and others don't think the VAX really meets their needs. Sensing the opportunity Tymshare has decided to OEM a DEC 20 compatible system from Foonly, Inc.

• AMDAHL ESTABLISHES BENCHMARK CENTER. With IBM, Amdahl, and NAS going head to head in many big bids, performance data is in demand. Showing faith in its 5860s, Amdahl has set up what it says is an advanced benchmarking facility that can produce realistic results. Not surprisingly, initial comparsions show that the 5860 outperforms the 3081K in the selected environments. Most independent observers have given the 3081K a slight edge, but no hard data has ever really existed. In the recent Australian Social Security contract, Amdahl was given the mainframe part of contract after extensive benchmarking, although Amdahl also came up with an aggressive price.

• LISA SOFTWARE COMING. Although it has gotten off to a rocky start, don't count Lisa out just yet. Expect a flood of third party software to hit the market soon. Apple reports that 165 software companies around the world are working on Lisa applications. Many have had Lisa specs for a long time.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

DAVID MOSCHELLA,EDITOR SEPT. 30, 1983 ● V/19,NO.10,11 P.J. MCGOVERN,PUBLISHER

VALUE OF WORLDWIDE COMPUTER SHIPMENTS TO GROW 17.3% PER YEAR OVER 1982-87 PERIOD: END-USER DEMAND TO LEAD WAY

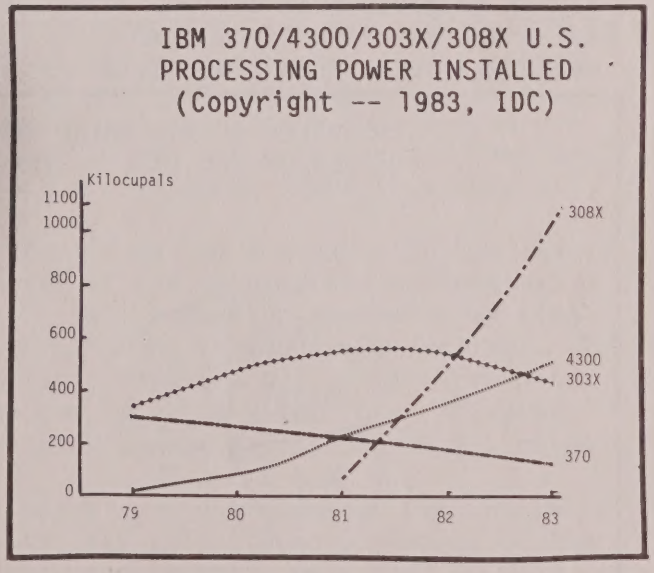
From mainframes to micros, the future of computing is now tied to the needs of an emerging class of demanding end users. Just as the 1970s proved to be the decade of the DP shop, the 1980s will see computers move into the office in a big way. And as the user base swells, the outlook for hardware sales looks bright. This steadily rising tide should lift all but the leakiest of boats.

Led by personal computing, on-line applications, text processing, and data base manipulation, users continue to show an almost insatiable demand for processing power. Consequently, system vendors are locked into an R&D-intensive price/performance war that shows no signs of ending. Minis challenge mainframes; desktops hit minis; and networks encompass all.

Some numbers. International Data Corporation (IDC), publisher of EDP/IR, forecasts that the value of worldwide shipments from U.S. suppliers will increase at a compound rate of 17.3% over the 1982-1987 period, from $34.4 billion to $76.6 billion. Shipments to the U.S. market will increase at 16.8% per year while international efforts will rise at an 18.3% annual rate. Led by desktop computers, worldwide unit shipments will grow at 44.8% per year.

The chart opposite depicts the accelerating pace of power consumption within the IBM world. In fact, in 1982, the processing power of the IBM mainframe installed base grew by 54%, and the power shipped in 1982 and 1983 will almost equal that of the previous 20 years. Mainframes remain healthy.

IDC coined the term "cupal" (not an acronym) as a relative performance measure. The number of cupals installed is derived by multiplying the cupal ratings of individual IBM machines by their respective installed populations. An IBM 360/20 has a rating of 1 cupal; the 3081K is rated at 675.



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VALUE OF U.S. COMPUTER SHIPMENTS, U.S.-BASED MANUFACTURERS, 1982-1987
(Copyright 1983 -- International Data Corporation)

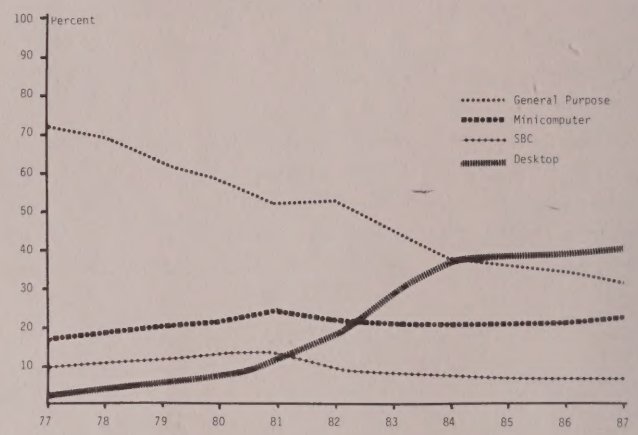
	1982 U.S. Shipments ($M)	1987 U.S. Shipments ($M)	Compound Annual Growth Rate
Mainframes	$11,780	$15,190	5.2%*
Minis	4,830	11,410	18.8
SBCs	1,990	3,110	9.3
Desktops	4,045	19,423	36.9

*Because mainframe shipments rates are highly cyclical, growth rates over a specific five-year period can be misleading, i.e, over the 1981-1987 period, mainframe growth is expected to be 10.1%.

The chart opposite shows the changing mix of processor markets over time. Although the value of desktop computer shipments will surpass those of general purpose in 1984, the relative rate of change will slow thereafter.

Perhaps more importantly, the chart gives an indication of how desktop shipments are affecting the share of both minis and SBCs. Note that the share of the market controlled by minis and SBCs peaked in 1981, and drops for the forecast period. 1981 also marks the real take-off point for the desktop market. EDP/IR believes that desktop sales are more likely to spur mainframe sales than limit them.

COMPOSITION OF U.S. COMPUTER SHIPMENT VALUE, 1977-1987
(Copyright 1983 -- IDC)



Note: Year markers represent end of year totals, i.e. the 1982 coordinates indicate total shipments during 1982.

VALUE OF WORLDWIDE COMPUTER SHIPMENTS, 1982-1987
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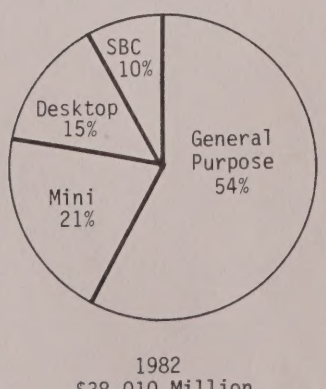
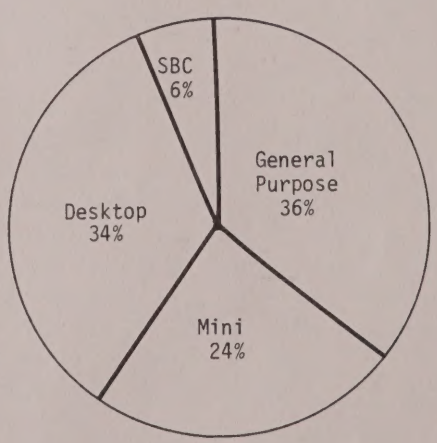


1982
$38,010 Million



1987
$76,618 Million

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WORLDWIDE NEW-BUILT SHIPMENTS, GENERAL PURPOSE COMPUTERS
U.S. BASED MANUFACTURERS, 1981-1982
(Copyright 1983 -- International Data Corporation)

	1982			1981	
	$M	% Total	% Δ	$M	% Total
IBM	13,265	71.2	34.8	9,740	65.1
Amdahl	344	1.8	13.9	302	2.0
NAS	269	1.4	40.8	191	1.3
Magnuson	11	0.1	-72.5	40	0.3
IPL	15	0.1	-28.6	21	0.1
Cambex	2	*	0	2	*
PCM Peripherals	1,235	6.6	21.7	1,015	6.7
Subtotal PCMs	1,876	10.0	19.4	1,571	10.4
Total IBM Base	15,141	81.2	33.9	11,311	74.8
Honeywell	650	3.5	-19.1	803	5.3
Sperry	1,005	5.4	-11.5	1,135	7.5
Burroughs	729	3.9	-14.2	850	5.6
NCR**	239	1.3	0.4	238	1.6
CDC	421	2.3	4.2	404	2.7
DEC	291	1.6	68.2	173	1.2
Cray	145	0.8	40.8	103	0.7
Denelcor	8	*	-	-	-
Total Non-IBM	3,488	18.8	-8.4	3,806	25.2
Grand Total	18,629	100.0	23.2	15,117	100.0

*Less than 0.05%. **NCR considers its 9040, 9050, amd 9300 systems to be general purpose, but IDC classifies them as small business computers, resulting in lower general purpose shipment figures than NCR would claim.

Mainframes in vogue

Perhaps the dominant mainframe development over the last two years has been the sense of renewed enthusiasm for the high end of the market. Large terminal networks, increased emphasis on data base systems, the requirements of IBM's MVS/XA and the strong economic recovery are creating a huge demand for CPU cycles which IBM has estimated to be in the 50% per year range. Over the forecast period, the high end will increase its shipment share (see page 4).

In fact, although they are often referred to as the dinosaurs of the industry, mainframes are once again becoming part of the information processing frontier. As large corporations start to view information resources as strategic assets, the central MIS operation is becoming increasingly critical. In just about any industry one looks at, leading companies are using large data bases to build new products or streamline company-wide operations. Flexible and effective information systems are emerging into a major competitive weapon.

On-line systems also continue to be a major source of demand. The nation's largest banks, with their huge ATM networks, are only the most visible of the giant, high-volume transaction networks that are becoming essential to many businesses. Mainframes are also at the center of a lot of decision support and artificial intelligence efforts, with the Japanese fifth generation project merely the most publicized. These expert, knowledge-based systems will help sustain demand throughout the decade.

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Thus far, however, the mainframe resurgence has been restricted to the IBM/PCM world. Burroughs and Honeywell are just now getting their big systems to market and Sperry won't start shipping its 1100/90s until 1984. EDP/IR doubts whether these companies can match the kind of growth enjoyed by IBM.

1982 marked a significant change in the financial performance of U.S. mainframe suppliers. Over the 1976-1981 period, Burroughs, Univac, NCR, Control Data, and Honeywell (Bunch) all grew faster than IBM. In 1982 and again in 1983 that trend has been turned around. In 1982, the non-IBM mainframers grew collectively at a dismal 2.0% while IBM expanded 18.2%. Although the Bunch are doing slightly better in 1983, the end results will look much the same.

There are, however, at least two significant exogenous factors. IBM has caught its traditional rivals between product cycles and IBM's efforts to convert lease and rental users to purchase are inflating its actual performance to some extent. Nonetheless, IBM's traditional rivals are being squeezed by slow growth and low profits at time when increased R&D is being required.

This is not to imply that the Bunch are standing still. CDC continues to mine the lucrative services and peripherals markets. NCR has revitalized its product line and is pursuing lots of new markets. Honeywell has come out with some innovative small computer products. Sperry has won several big military contracts and reports healthy orders for its delayed 1100/90 series. Burroughs, however, has over the last year remained eerily quiet.

Joint ventures are also proving popular. Bunch members are teaming up in peripheral projects and are all part of the CDC-inspired Microelectronics and Computer Technology joint effort. They are also cutting deals with both Japanese firms and start-ups such as Convergent Technologies. The Bunch have realized that they need outside help if they are to remain full-line suppliers.

The IBM plug-compatible manufacturers face a different situation. After a weak and unprofitable 1982, both Amdahl and NAS are enjoying a very strong 1983. On the other hand, suppliers of 4300-type systems are feeling the heat

INFORMATION PROCESSING REVENUES -- LEADING MANUFACTURERS
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	1977	1982	Compound Growth	1982 Growth
IBM	14,765	28,934e	14.4e	20.2e
Burroughs	2,127	4,186	14.5	22.9*
DEC (6/30)	1,059	3,881	29.7	21.4
NCR	2,521	3,526	6.9	2.7
CDC	1,513	3,301	16.9	5.8
Sperry (3/31)	1,726	2,818	10.3	-0.1
HP (10/31)	588	2,168	29.8	22.4
HIS	1,037	1,685	10.2	(5.0)
Wang	178	1,159	45.5	35.4
STC	162	1,079	46.1	17.0
Total	25,676	52,737	15.5	16.2

Notes. IBM 1982 figures are IDC estimates since IBM no longer breaks out its typewriter business separately. *Burroughs 1982 growth is primarily due to the aquisition of Memorex.

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of IBM's aggressive price cutting and new products, and 1983 prospects aren't bright. PCM peripheral makers are also having lots of problems. Delays in 3380-type drives have brought Storage Technology down to earth. By April, IBM had shipped 15,000 3380s; PCMs STC, CDC and Memorex are just getting started. To limit PCM impact, IBM has been trying to convert its 3380 base to purchase.

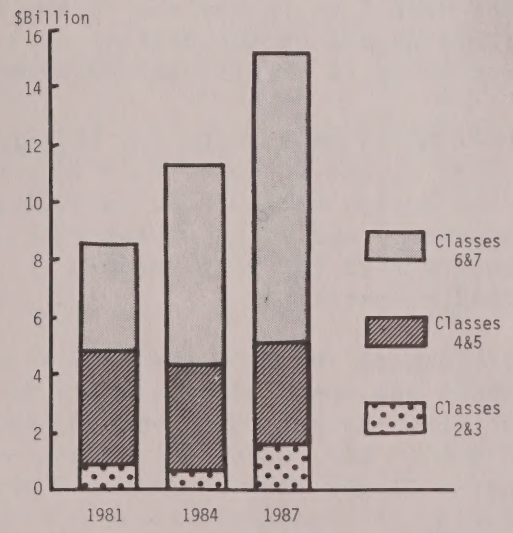
Thanks to high-volume sales of IBM's large 3081 processors (840 in the U.S. alone), 1982 turned out to be an exceptionally good year for the mainframe market with the value of worldwide shipments up 23% over a weak 1981. Thanks to a pick-up in international sales, 1983 will show growth of 16.4%. Since IDC does not expect IBM's Sierra series until 1985, 1984 looks like an off year.

Sales of 4300 machines are dwindling. The system that rocked the industry in 1979 is now some four years old, and replacement products will continue to be announced over the next twelve months, resulting in considerable churning of the size class 2, 3, 4, and 5 bases over the 1984-85 period. With the introduction of the S/36, S/38 sales will tend to focus on the larger models. Shipments of S/38s to the U.S. market reached some $500 million in 1982.

This segment of the market has come under increasing attack from vendors of minicomputers, and even from some microprocessor-based systems. But over the last 18 months, IBM has emerged as a very aggressive price competitor in the mid-range market. Magnuson was one who couldn't keep up, but even some of IBM's traditional mainframe rivals are feeling the price pressure. The price/performance of IBM's 4300 replacements -- code named Glendale and Olympia -- will have significant repercussions for mini and mainframe vendors alike.

With the entrance of Fujitsu, Hitachi, and NEC, competition in the supercomputer market has heated up, and rumors persist that IBM is taking a hard look at the market. But given the high development costs, this market will be unable to support many vendors until vector processing machines begin to penetrate commercial environments. If they can't, supercomputer competition will come down to U.S. vs Japanese supremacy, with all its political ramifications.

VALUE OF U.S. GENERAL PURPOSE SHIPMENTS BY SIZE CLASS, 1981-1987
(Copyright 1983 -- International Data Corporation)



IDC Size Classes for IBM CPUs

Model	Class
System/38-3	2
370/115	3
System/38-5	3
4331-1	3
370/138	4
4331-2	4
4341-1	4
370/148	5
4341-2	5
370/158	6
3031	6
3083	6
370/168	7
3033	7
3081	7

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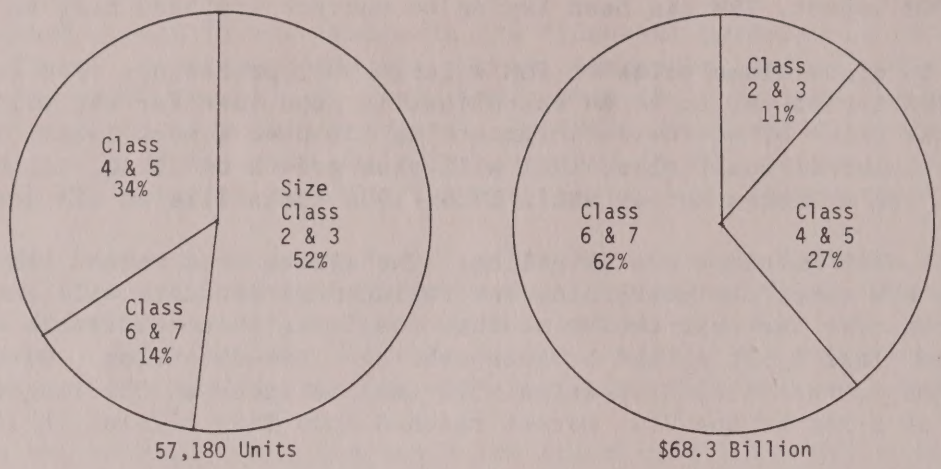
1982 U.S. GENERAL PURPOSE INSTALLED BASE BY SIZE CLASSES, UNITS AND DOLLAR VALUE
(Copyright 1983, International Data Corporation)



Turmoil in the mini market

The sudden change in the financial performance of the major mini makers is perhaps the best evidence of how quickly this market is changing. 1982 saw growth at Data General take a pounding; in 1983 DEC, Hewlett-Packard Prime, and Tandem have felt earnings squeezes. For most of these companies, this is the first time that they've had to deal with anything but growth and accolades. Only Wang, with its text processing emphasis, has thus far remained immune.

The minicomputer market has always been more affected by the economy than the mainframe sector which is heavily product-cycle driven. But even a return to a robust economy will not guarantee a re-run of the high growth 1970s. Faced with changing markets and competitors, life has gotten more difficult.

With significant competition from desktop computers, start-ups, and more head-to-head battles with IBM, mini makers have been scrambling to shore-up their product lines. Just as mainframers were late in getting to the mini market, mini vendors have sat out of the early rounds of the desktop market, and 1984 will be the first year when desktops bring in significant revenues.

DG and Honeywell have already put their minis on a chip, and EDP/IR expects other mini vendors to follow. DEC may wish it had followed this approach with its software-starved Professional 350, and HP has talked about a 3000-based micro. Microprocessor-based, single and multi-user systems that run existing mini software have emerged as one of the few ways for mini vendors to differentiate their desktops from the entrenched competition.

With sales of small minis relatively sluggish, most of the mini vendors are also looking increasingly to office systems and powerful superminis for future growth. Data General shook up the group with its powerful MV/10000 which has since been followed by Prime's high-end 9950. DEC, which got caught napping at the high end, is scrambling to get out a larger Vax, sometimes dubbed the 790, sometimes the 810. This new generation of superminis squares off directly with IBM's 4300 products in many user environments, especially as IBM continues to stress the scientific/engineering performance of its 4300 systems.

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Mini forecast

IDC segments the minicomputer market into three categories -- microminis, typified by DEC's LSI/11 products; traditional minis, generally 16-bit and characterized by DEC's PDP-11 products; and superminis, usually 32-bit and typified by DEC's Vax/750 and /780 products. In terms of price, microminis have an average purchase price of about $3,500; traditionals range from $10,000 to around $50,000; superminis go from as low as $50,000 up towards $500,000.

Each of these markets is facing changing competition. At the low-end, the growth of micromini shipments is being blunted by increasingly powerful and flexible desktop computers. IDC sees this market remaining virtually flat over the 1982-87 period. Although unit shipments will grow at 3.1% per year, falling prices will leave shipment revenues similar to 1982's $250 million. A large OEM software base remains this market's major raison d'etre.

After a long period of dormancy characterized by both slow growth and few product introductions, the traditional minicomputer market should enjoy a mild rebirth over the forecast period. New emphasis on small multi-user systems and scaled-down 32-bit processors should make for lots of new products. Growth rates, however, continue to prove that this is a rather mature market. From 1982-87, worldwide unit shipments will rise 10.6%/year with value rising 8.1%.

Superminis continue to be where the action is for mini suppliers who are engaged in a price/performance race reminiscent of the mainframe market. Worldwide supermini shipment value will increase at 24.3% over the forecast period, reaching an impressive $12.3 billion by 1987. Because of their fast growth, superminis continue to attract lots of startups and venture capital, with fault tolerant and multiple microprocessor-based systems particularly in vogue.

WORLDWIDE MINICOMPUTER SHIPMENTS BY U.S.-BASED MANUFACTURERS, 1981-1982
(Copyright 1983 -- International Data Corporation)

	1982 $M Revenue	1981 $M Revenue	1982 % Share*	1982 Units Shipped	1981 Units Shipped	1982 % Share*
DEC	3,700	3,340	37.8	83,590	74,180	47.4
Hewlett-Packard	1,608	1,233	16.4	14,810	12,004	8.4
Data General	804	764	8.2	17,050	16,800	9.7
Honeywell	718	623	7.3	2,912	6,659	1.7
Texas Instruments	650	402	6.6	18,540	9,810	10.5
IBM	603	496	6.1	11,900	9,500	6.7
Prime	435	365	4.4	2,025	1,799	1.1
Tandem	335	243	3.4	1,502	1,401	0.9
Perkin Elmer	198	225	2.0	1,670	1,835	0.9
SEL	170	122	1.7	977	700	0.5
Harris	132	84	1.3	442	402	0.3
Modcomp	92	87	0.9	618	776	0.4
CAI	68	72	0.7	10,585	4,245	6.0
GAI	58	82	0.6	1,370	1,730	0.8
Sperry	44	133	0.4	191	1,562	0.1
Others	193	145	2.0	8,318	7,319	4.7
TOTAL	9,808	8,416	99.8	176,500	150,722	100.1

*Percentages do not add to 100 due to rounding.

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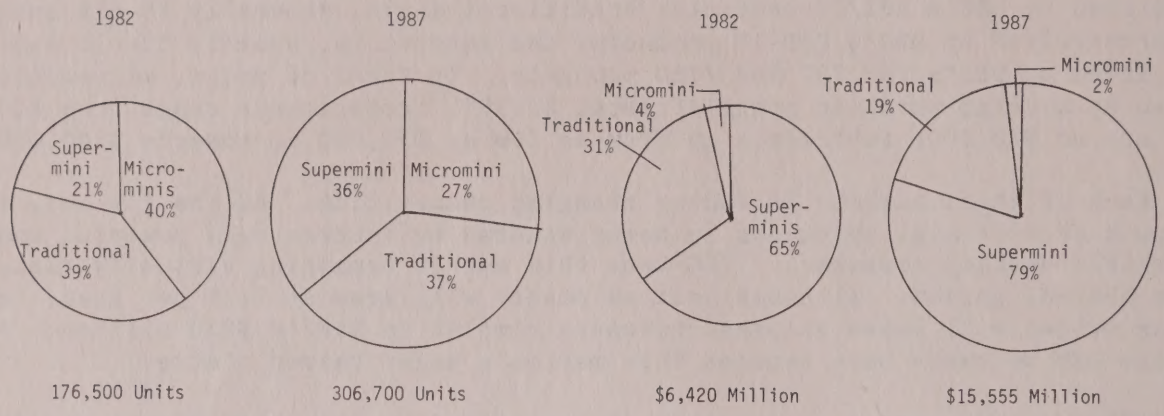
WORLDWIDE MINICOMPUTER SHIPMENTS, U.S.-BASED MANUFACTURERS, 1982-1987
(Copyright 1983 -- International Data Corporation)



Figures do not include add-on peripherals and thus do not match the numbers on the red pages.

Small business market, vertical opportunities

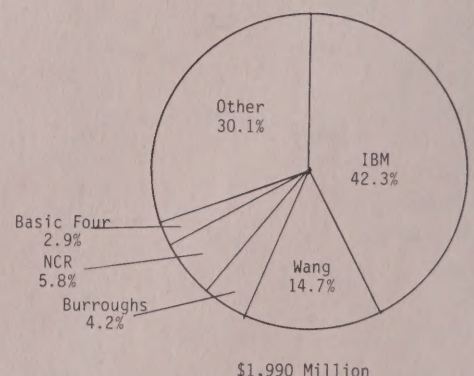
Although the small business market is seemingly besieged by problems and competition -- desktops, minis, support costs, the recession, etc. -- there are still opportunities. Desktop computers often do not have the software needed for many small business tasks, and vendors who sell through retail outlets are not equipped to offer high levels of support. A well positioned product in the right vertical market can still be quite successful as many new and experienced users still like to buy fully packaged systems.

The big news in this market was certainly IBM's announcement of the System/36. But the S/36 as announced serves only the upper segment of the market. IBM's Datamaster has not been particularly successful at the low end, and thus EDP/IR expects that IBM will announce a smaller version of the S/36, both to pick up some of the small System/34 base and to better to compete with companies such as Altos. IBM has called the S/36 the "first of a family."

At the low-end, SBC vendors are scrambling to incorporate their software with today's powerful microprocessors and winchester disks so that they can better compete with desktop prices. Since the primary competition is normally from desktop computers, many SBC vendors are focusing much of their effort on the low and middle parts of the market, with the hope of future upgrades.

Despite the opportunities, SBCs remain a difficult market which is likely to produce as many losers as winners. IDC forecasts that U.S. units shipments will grow at 11.3% over the 1982-1987 period, with value rising 9.3%. The figures for the international market are 11% and 8%, respectively.

1982 U.S. SBC SHIPMENTS
(Copyright 1983 -- IDC)



$1,990 Million

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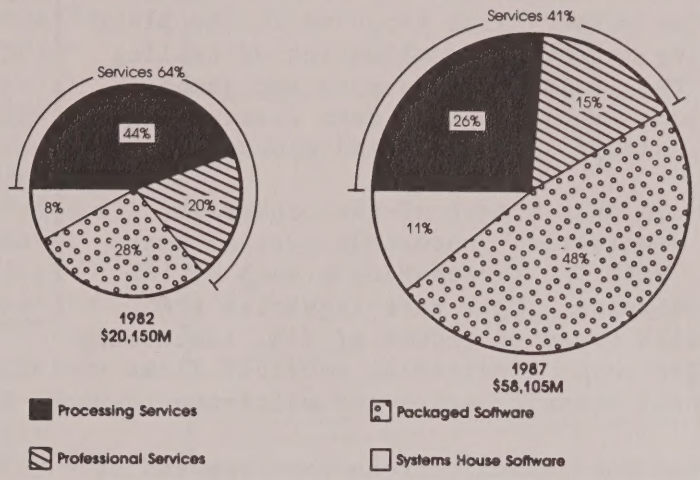
MARKET SEGMENTATION OF WORLDWIDE VALUE-ADDED SERVICES MARKET,
U.S.-BASED VENDORS, 1982-1987
(Copyright 1983 -- International Data Corporation)



In 1982, the worldwide revenues of value-added suppliers -- software along with processing and professional services -- reached $20.1 billion, just a shade under those for general purpose mainframes, and far above the revenues for any other industry sector. Although the importance of software has been recognized for some time, the magnitude of the software delivery industry has often gone unrecognized, perhaps because of its highly fragmented nature.

IDC expects the overall value-added market to expand at 23.6% per year through 1987, a remarkable rate given the size of the industry. In fact, in 1983 value-added services will become the largest market of all, and not even the fast-growing desktop computer market will be able to catch it. In terms of growth, packaged software will lead the way (37%), followed by system house software (32%), professional services (17%), and processing services (12%).

Given today's application backlogs, end-user demand, proliferating hardware, and rising programmer costs, a bright future for packaged software is assured. From mainframes to micros, the action is fast. Some key software areas:

- Mainframes. Data base management and fourth generation languages are gaining status. IBM's new relational Data Base 2 software signals the giant's recognition of the need for end user oriented facilities. Where would Sperry be without Mapper? All the mainframers continue to court third party groups for application software, not for the software revenues but to help sell hardware.

- Minis. Unix is steadily emerging as an industry standard among new and established vendors alike. Rumors persist that IBM will announce support of Unix on its 4300 machines. A standard operating system would help spur mini packaged software development activity.

- Micros. IBM's open architecture has opened the flood gates, and growth rates here will exceed 50% per year through 1987. Bundled, integrated WP/DP systems are also proving popular.

- Artificial Intelligence. Today's work on decision support systems and fifth generation computers will lead to important future markets.

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Processing services, some ups and downs

TOP 10 INDEPENDENT VALUE-ADDED SUPPLIERS (1982 REV. $M)	
ADP	$706
CSC	683
Geisco	585
EDS	562
McAuto	295
Tymshare	243
Arthur Anderson	188
Informatics	170
Shared Medical	166
Boeing Comp. Ser.	157

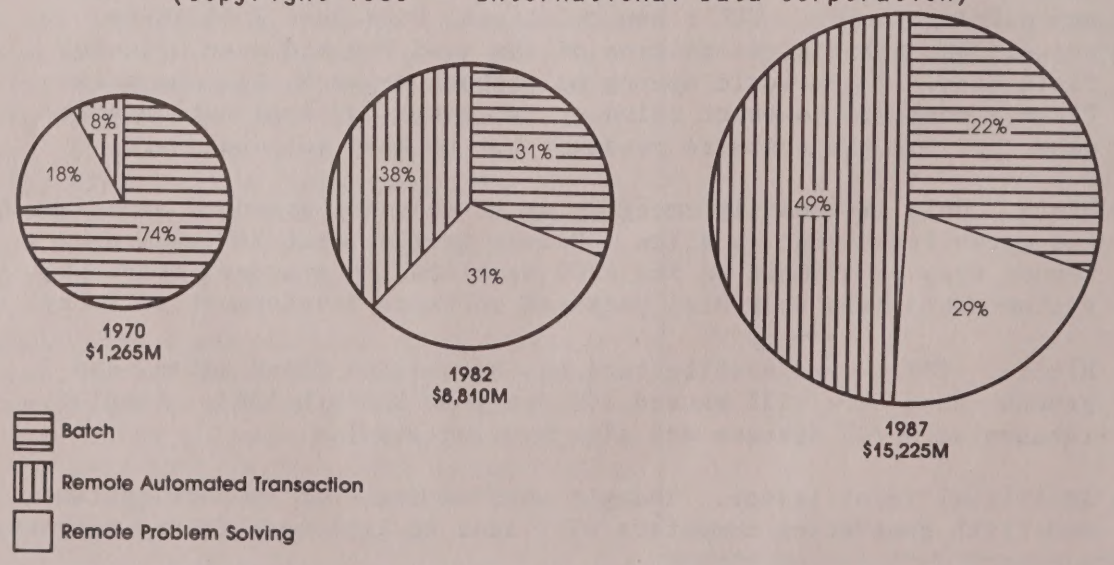
The lackluster 11.6% growth in the processing services market is due primarily to troubles in the plain vanilla timesharing market. A combination of falling hardware prices, the prolonged recession and competition from desktops will make long term timesharing growth difficult, except in specialized niches.

But this gloom is only a part of the processing services story. Transaction processing systems continue to flourish, with IDC forecasting growth of 18% over the next five years. Data base inquiries are also a hot area with expected growth of 23%, admittedly from a much smaller base. Processing services firms are also putting increased emphasis on personal computer sales and mainframe-to-micro links.

Given the demand for communications services and user difficulties in building and operating large teleprocessing networks, it's no wonder that over the last few years interest in packet switched networks has soared. EDP/IR counts ten vendors that have at least announced plans to enter this market, with Geisco, United Information Services, National Data Corp. and Computer Sciences among the value-added entrants. Because of their long experience with both remote computing and customized systems, some service companies see themselves as the logical builders of the inter and intra-company networks of the future. IBM and AT&T have their own ideas, of course.

Besides IBM and AT&T, other new competitors are emerging from specific industries such as banking, accounting and insurance, and the value-added market continues to be acquisition prone. IDC counted 138 takeovers in 1982, up from 125 in 1981. The most notable acquisition was Dun and Bradstreet's pick up of McCormack and Dodge, but the great majority are very small. A sluggish international business is another constant, with only remote problem solving companies doing a substantial overseas business.

SEGMENTATION, WORLDWIDE PROCESSING SERVICES MARKET
U.S.-BASED VENDORS, 1970-1987
(Copyright 1983 -- International Data Corporation)



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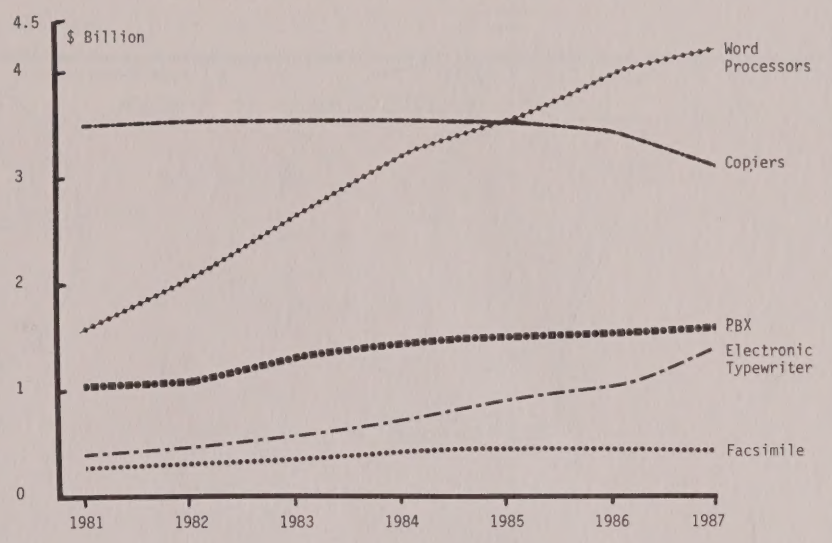
OFFICE AUTOMATION EQUIPMENT, VALUE OF SHIPMENTS ($M)
(Copyright 1983 -- International Data Corporation)

The data opposite is for equipment sales only; it does not include revenues for service, software, installation etc. For copiers, service and supply revenues can compare to sales. PBX figures reflect wholesale, if-sold assumptions. End-user PBX costs often include installation and may total as much as 2.5 times the wholesale figure. Electronic typewriter, fax, and WP auxillary costs are less significant.



Office rundown

The growth rates shown above should not be taken to mean that office automation has lost the hot market status of a few years ago. Since desktops, minis and even mainframes are all being used to automate office workflows, the equipment numbers above should be viewed merely as forecasts for specific types of devices, the sum total of which comprise only a small portion of total office automation spending.

The real office automation market includes everything from payroll processing to electronic mail to decision support to spreadsheets, and is thus as much software as hardware oriented. Nevertheless, the specialized products shown above are important parts of the overall office automation picture.

The leveling-off of the copier market has already sent several companies into chapter 11, and is the best reason why Xerox knows that, no matter how rocky the road, it must not fail in its return to the information processing business. Because the copier market is relatively saturated, only an opening up of the home market could inject significant growth into the market. Increasingly, copier firms are relying on revenues from service and supplies.

Typing-oriented machines -- word processors and electronic typewriters will both do well over the forecast period. Although desktop computers and, increasingly, minicomputers are being sold with text processing software, no desktop or minicomputer system on the market today can match the functionality of dedicated WP machines, and as long as this is true, growth will continue.

PBXs have attracted much more vendor attention than their 8.4% projected growth rate might seem to warrant. IBM's 17.7% stake in Rolm capped a series of major computer/PBX alliances, and PBX data switching capabilities are now a driving force in the market. The emergence of a competitive AT&T and its new Dimension 85 has also centered attention on PBXs. Although the PBX vs. local area network debate continues, there is now little doubt that digital PBXs will be an important part of many office automation systems.

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U.S. DATA ENTRY TERMINAL MARKET, 1982-1987
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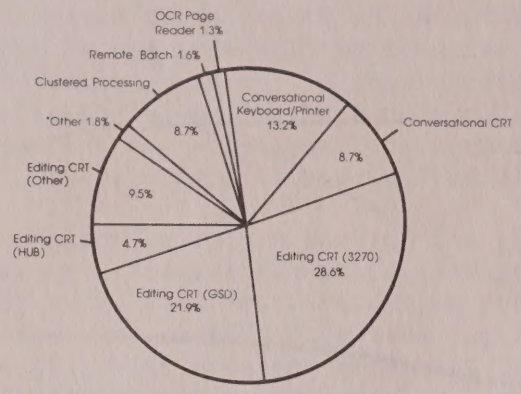
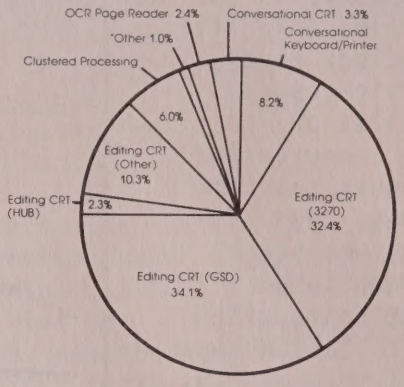


1982
Total $ Value Shipped
$3,365,100,000

*Other

OCR Line Reader .67%
Keypunch .04%
Key-to-Diskette .25%
Key-to-Disk .63%
Editing KSR .22%



1987
Total $ Value Shipped
$4,771,700,000

*Other

Remote Batch .3%
OCR Line Reader .5%
Key-to-Disk .1%
Editing Keyboard/Printer .1%

Terminals, withstanding the threat

Given the booming activity in the desktop market, the terminal market is showing surprising vitality. IDC expects that unit shipments in the U.S. will grow at 20.4% over the 1982-1987 period, but because of falling prices shipment value will rise just 11.5%. Lower prices, the limited requirements of many tasks (such as data entry) and easier links to large computers are three reasons why terminal sales will remain solid.

The terminal market remains highly fragmented. IBM dominates with 30% of 1982 shipments, but shares drop off sharply after that with DEC in second place at 8%, and no one else over 5%. Within the 3270 market, IBM has watched its share steadily erode, but in 1982 it brought out its smaller low-priced 3178 which has squeezed profit margins at PCM terminal makers such as Memorex, Telex, ITT, Raytheon, and Lee Data.

In 1982 IBM recognized the overlap between terminals and PCs by offering a 3270 to PC upgrade package, following similar moves by DEC and Sperry, but EDP/IR thinks that the importance of such offerings is largely symbolic. IBM also brought its large flat panel display to market, and the portable computer market continues to spur attempts to develop flat panel technology.

NOTES TO CENSUSES AND FORECASTS

- Inflation -- The value of computer system shipments shown in the Review and Forecast pages (in red) represents the if-sold, quantity-one price of equipment at the time of sale. All figures are in nominal dollars.

- Value -- The value of shipments and installed base includes peripheral sales based on IDC's Average System Values, shown in the census sections.

- Installed base -- The number in use column accounts for retirements. For the minicomputer and small business figures retirements are done only on an aggregate basis; they are not reflected in the census sections.

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COMPUTER MARKET SUMMARY -- U.S. BASED MANUFACTURERS
(Copyright 1983 -- International Data Corp.)

	Number of Systems Shipped	Cumulative Number in Use	$ Million Value Shipped	$ Billion Value in Use
		WORLDWIDE		
1977	164,400	547,300	16,310	89.4
1978	212,000	840,400	20,100	105.3
1979	458,400	1,261,600	23,030	121.5
1980	683,900	1,909,100	26,400	140.5
1981	1,059,100	2,922,300	27,710	154.6
1982	3,530,400	6,411,100	34,440	180.0
1983	6,827,700	13,187,100	42,890	211.5
1984	10,783,600	23,909,900	48,210	243.7
1985	14,371,600	38,208,400	59,240	287.4
1986	18,269,100	56,396,700	70,400	340.9
1987	22,454,000	78,761,900	76,610	397.2
		UNITED STATES		
1977	112,300	355,000	9,070	50.6
1978	126,600	564,900	11,010	59.1
1979	295,600	832,500	12,530	67.6
1980	463,000	1,268,100	15,190	78.6
1981	728,800	1,967,300	16,520	89.5
1982	2,791,400	4,729,700	22,370	106.3
1983	5,256,900	9,951,900	26,200	124.9
1984	8,279,800	18,190,900	30,990	145.8
1985	10,629,300	28,772,800	36,790	175.2
1986	12,890,500	41,610,100	43,520	210.3
1987	15,163,700	56,714,400	48,590	246.4
		INTERNATIONAL		
1977	52,100	192,300	7,240	38.8
1978	85,400	275,500	9,090	46.2
1979	162,800	429,100	10,500	53.9
1980	220,900	641,000	11,210	61.9
1981	330,300	955,000	11,190	65.1
1982	739,000	1,681,400	12,070	73.7
1983	1,570,800	3,235,200	16,690	86.6
1984	2,503,800	5,719,000	17,220	97.9
1985	3,742,300	9,435,600	22,450	112.2
1986	5,378,600	14,786,600	26,880	130.6
1987	7,290,300	22,047,500	28,020	150.8

This computer market summary shows the total of all general purpose computers, minicomputers, small business computers, and desktop computers. Minis used in SBCs are subtracted to avoid double counting.

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GENERAL PURPOSE COMPUTER MARKET -- U.S. BASED MANUFACTURERS*
(Copyright 1983 -- International Data Corporation)

	Number of Systems Shipped	Cumulative Number in Use	$ Million Value Shipped	$ Billion Value in Use
		WORLDWIDE		
1977	17,800	111,500	12,500	77.7
1978	10,800	113,000	14,740	88.6
1979	10,200	105,500	15,710	98.2
1980	19,900	110,300	16,610	108.1
1981	20,900	109,400	15,120	110.3
1982	18,300	115,700	18,630	120.5
1983	16,500	118,400	21,690	131.9
1984	18,000	121,900	19,940	137.4
1985	29,400	133,600	24,600	148.1
1986	29,500	146,900	28,840	162.1
1987	28,600	159,100	27,900	172.0
		UNITED STATES		
1977	8,900	58,200	6,600	42.9
1978	4,300	58,000	7,590	48.4
1979	4,700	53,200	8,020	53.0
1980	9,800	54,700	8,880	58.2
1981	10,400	55,100	8,540	61.6
1982	9,300	57,200	11,780	68.3
1983	8,300	58,500	11,750	73.2
1984	9,600	60,100	11,400	75.6
1985	14,300	65,600	12,920	82.1
1986	14,200	71,500	15,050	90.1
1987	14,100	76,500	15,190	94.3
		INTERNATIONAL		
1977	8,900	53,300	5,900	34.8
1978	6,500	55,000	7,150	40.2
1979	5,500	52,300	7,690	45.2
1980	10,100	55,600	7,730	49.9
1981	10,500	54,300	6,580	48.7
1982	9,000	58,500	6,850	52.2
1983	8,200	59,900	9,940	58.7
1984	8,400	61,800	8,540	61.8
1985	15,100	68,000	11,680	66.0
1986	15,300	75,400	13,790	72.0
1987	14,500	82,600	12,710	77.7

* Sales by international manufacturers with U.S.-based sales offices are counted in U.S. totals, but not international.

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MINICOMPUTER MARKET -- U.S.-BASED MANUFACTURERS*
(Copyright 1983 -- International Data Corp.)

	Number of Systems Shipped	Cumulative Number in Use	$ Million Value Shipped	$ Billion Value in Use
		WORLDWIDE		
1977	83,300	312,700	2,410	7.4
1978	103,100	407,600	3,170	10.4
1979	124,700	518,400	4,010	14.1
1980	151,000	654,100	5,040	18.8
1981	150,700	786,700	6,480	24.8
1982	176,500	941,400	7,550	32.1
1983	185,500	1,098,800	8,560	40.0
1984	209,200	1,274,600	10,060	49.3
1985	238,800	1,474,100	12,330	60.7
1986	270,700	1,699,400	15,300	74.9
1987	306,700	1,956,000	18,410	92.1
		UNITED STATES		
1977	60,800	215,500	1,570	4.8
1978	71,700	277,300	2,000	6.6
1979	82,100	345,500	2,550	8.8
1980	92,100	423,100	3,230	11.8
1981	91,900	499,500	4,080	15.5
1982	114,700	597,000	4,830	20.1
1983	120,600	695,700	5,480	25.1
1984	133,900	804,000	6,340	30.9
1985	150,400	924,700	7,770	38.0
1986	167,800	1,058,500	9,490	46.7
1987	187,100	1,208,700	11,410	57.2
		INTERNATIONAL		
1977	22,500	97,200	840	2.6
1978	31,400	130,300	1,170	3.8
1979	42,600	172,900	1,460	5.3
1980	58,900	231,000	1,810	7.0
1981	58,800	287,200	2,400	9.3
1982	61,800	344,400	2,720	12.0
1983	64,900	403,100	3,080	14.9
1984	75,300	470,600	3,720	18.4
1985	88,400	549,400	4,560	22.7
1986	102,900	640,900	5,810	28.2
1987	119,600	747,300	7,000	34.9

* Sales by international manufacturers with U.S.-based sales offices are counted in U.S. totals, but not international.

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SMALL BUSINESS COMPUTER MARKET -- U.S.-BASED MANUFACTURERS*
(Copyright 1983 -- International Data Corp.)

	Number of Systems Shipped	Cumulative Number in Use	$ Million Value Shipped	$ Billion Value in Use
		WORLDWIDE		
1977	33,100	72,100	1,270	2.8
1978	42,900	113,500	1,840	4.6
1979	55,800	164,900	2,610	7.0
1980	65,700	225,800	3,200	10.0
1981	71,100	291,000	3,530	13.4
1982	73,100	355,600	3,480	16.5
1983	75,700	420,200	3,530	19.5
1984	85,100	490,400	3,920	22.8
1985	98,100	569,530	4,380	26.4
1986	111,100	657,700	4,850	30.2
1987	124,100	755,300	5,300	34.3
		UNITED STATES		
1977	20,500	47,500	810	1.9
1978	27,500	73,500	1,160	3.0
1979	30,200	100,000	1,450	4.3
1980	39,300	135,500	2,080	6.2
1981	42,400	173,800	2,100	8.2
1982	41,400	210,000	1,990	9.9
1983	41,500	244,800	1,950	11.6
1984	46,400	282,700	2,180	13.4
1985	54,400	326,400	2,500	15.5
1986	62,500	375,800	2,810	17.7
1987	70,700	430,500	3,110	20.0
		INTERNATIONAL		
1977	12,600	24,600	460	0.9
1978	15,400	40,000	680	1.6
1979	25,600	64,900	1,160	2.7
1980	26,400	90,300	1,120	3.8
1981	28,700	117,200	1,430	5.2
1982	31,700	145,600	1,490	6.6
1983	34,200	175,400	1,580	7.9
1984	38,700	207,700	1,740	9.4
1985	43,700	243,100	1,880	10.9
1986	48,400	281,900	2,040	12.5
1987	53,400	324,800	2,190	14.3

* Sales by international manufacturers with U.S.-based sales offices are included in U.S. totals, but not international.

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GENERAL PURPOSE COMPUTER CENSUS

Counts in the General-Purpose Computer Census are based on the best information available to IDC but are estimates nevertheless. General-Purpose computers -- as characterized by IBM's System/3, System/38, 370, 4300, 303X, and 308X, and competitors -- are designed for use in a wide variety of applications. They are character or byte oriented and programmed in higher level languages. Many of the General-Purpose computer manufacturers also market smaller systems, also general-purpose in design, which are included in the Small Business Computer and Minicomputer censuses.

Instead of being defined by shifting average purchase or rental values, size classes are based on IBM products and other manufacturers' models that compete with them, e.g., a computer in size class 7 would compete with an IBM 3081. Average purchase and monthly rental values are based on system price including peripherals except for plug-compatible vendors Amdahl, Cambex, Control Data Corporation-Omega, IPL, Magnuson, and National Advanced Systems, where only CPU value is counted. An "X" in the last column means none will be shipped from the original manufacturer, and an "*" means none will be shipped until after 1983.

GENERAL-PURPOSE CENSUS AS OF JANUARY 1, 1983

Name of Manufacturer	Computer Model	Old Size Class	New Size Class	Average Purchase Price ($000)	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Amdahl	470V/5 II	6	L	2,205	09/77	37	32	69	X
	470V/6 II	7	VL	3,260	06/75	126	50	176	X
	470V/7, A, B	7	VL	2,385	09/78	132	102	234	X
	470V/7C	6	L	1,100	02/81	40	22	62	9
	470V/8	7	VL	2,432	09/79	151	94	245	10
	580/5850	7	VL	2,750	2Q/83	0	0	0	50
	580/5860	7	VL	3,150	08/82	13	1	14	100
	580/5870	7	VL	5,200	4Q/83	0	0	0	5
	580/5880	7	VL	6,200	4Q/83	0	0	0	6
	TOTAL					499	301	800	180
Burroughs	2/3/500	3	M	315	11/61	94	44	138	X
	1710	2	M	139	12/75	267	291	558	X
	1720	3	M	350	02/73	196	198	394	X
	1815/25/30	2	M	122	05/77	259	469	728	X
	1855/60/70/85	3	M	254	05/77	981	311	1,292	X
	1905	2	M	99	04/80	238	135	373	30
	1955/85	3	M	195	04/80	1,412	1,070	2,482	500
	2500	4	M	499	02/67	2	5	7	X
	2700	4	M	530	08/72	63	44	107	X
	2800	4	M	442	12/76	195	115	310	X
	2900	4	M	500	07/80	338	191	529	10
	2925	4	M	362	02/83	0	0	0	250
	3500	4	M	910	05/67	125	81	206	X
	3700	4	M	1,230	11/72	127	136	263	X
	3800	4	M	661	04/77	217	49	266	X
	3955	4	M	730	09/81	108	20	128	100
	45/4700	5	L	1,560	10/71	149	70	219	X
	4800	5	L	1,351	09/76	302	105	407	20
	4955	5	L	1,770	3Q/83	0	0	0	70
	55/5700	5	L	1,680	03/63	15	7	22	X
	5920	5	M	420	3Q/82	43	7	50	120
	5930	5	M	543	01/81	50	75	125	40
	65/6700	6	L	3,168	11/69	127	100	227	X
	6800	5	L	1,711	06/77	305	120	425	X
	6900	5	L	2,226	11/80	105	51	156	10
	6925	5	L	947	3Q/82	12	3	15	100
	7700	5	L	6,440	08/73	38	25	63	X
	7800	7	VL	5,062	11/78	129	31	160	10
	7900 F, H, K	7	VL	6,600	3Q/83	0	0	0	50
	TOTAL					5,897	3,753	9,650	1,310
Cambex	1636	4	M	100	10/81	6	0	6	X
	1636-10	4	M	98	1Q/83	0	0	0	10
	1638/40	4	M	118	01/79	5	4	9	X
	1641	4	M	175	10/80	6	15	21	X
	1641-11	4	M	170	2Q/83	0	0	0	6
	1651	5	M	200	2Q/82	5	3	8	X
	1651-11	5	M	245	2Q/83	0	0	0	4
	TOTAL					22	22	44	20
Control Data Corp.	Omega 480-1	4	M	360	06/77	71	1	72	X
	Omega 480-2	5	M	367	08/78	63	3	66	X
	Omega 480-3	5	M	420	01/80	55	2	57	X
	Subtotal					189	6	195	0
	Cyber 170-720	5	L	1,525	05/79	80	115	195	5
	Cyber 170-730	6	L	2,247	06/79	75	35	110	5
	Cyber 170-740	6	L	3,041	04/80	10	5	15	5
	Cyber 170-750	6	VL	4,514	08/79	30	15	45	5
	Cyber 170-760	7	L	5,767	04/79	40	8	48	5
	Cyber 71	4	M	977	07/76	1	3	4	X
	Cyber 171	4	M	1,111	08/77	13	39	52	X
	Cyber 72	5	L	1,810	10/71	6	17	23	X
	Cyber 172	6	L	2,006	07/75	15	40	55	X
	Cyber 73	6	L	2,630	03/72	22	28	50	X
	Cyber 173	6	L	3,333	09/75	8	19	27	X
	Cyber 74	7	VL	5,000	03/72	25	12	37	X
	Cyber 174	6	L	4,178	09/75	13	13	26	X
	Cyber 175	7	VL	6,165	08/75	31	23	54	X
	Cyber 76	7	VL	7,905	03/72	8	9	17	X
	Cyber 176	7	VL	7,550	01/78	17	3	20	X
	Cyber 203	7	VL	9,961	11/80	4	-	4	2
	Cyber 205	7	VL	11,010	01/81	6	3	9	5
	Cyber 170-825	4	M	890	03/82	20	15	35	60
	Cyber 170-835	5	L	1,820	03/82	12	18	30	50
	Cyber 170-855	6	L	3,790	11/82	2	3	5	30
	Cyber 170-865	7	VL	4,650	3Q/83	0	0	0	10
	Cyber 170-875	7	VL	6,095	3Q/82	0	0	0	7
	Cyber 170-875 dual	7	VL	8,640	3Q/83	0	0	0	3
	Subtotal					438	423	861	192
	G-20	4	M	830	04/61	1	-	1	X
	1604	6	L	1,750	01/60	5	-	5	X
	31/3150	4	M	419	12/64	20	10	30	X
	3170	5	L	970	12/70	8	4	12	X
	3200	4	M	625	05/64	13	10	23	X
	3300	5	L	1,491	09/65	68	23	91	X
	3400	5	L	1,019	11/64	2	-	2	X
	3500	5	L	1,341	01/69	24	12	36	X
	3600	6	L	2,107	06/63	5	3	8	X
	3800	6	L	2,568	12/65	12	-	12	X
	6200	6	L	1,825	11/70	-	-	-	X
	6400	6	L	2,723	05/66	30	9	39	X
	6500	6	L	3,700	12/67	12	10	22	X
	6600	7	VL	4,990	08/64	37	13	50	X

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Control Data Corp. (Continued)	6700	7	VL	6,005	07/70	2	-	2	X
	7600	7	VL	8,200	01/69	24	3	27	X
	Star 100	7	VL	12,000	12/74	-	-	-	X
	Subtotal					263	97	360	0
	TOTAL					890	526	1,416	192
Cray	1A, 1B	7	VL	8,290	04/76	10	7	17	X
	1S	7	VL	8,200	11/80	26	5	31	6
	XMP 22	7	VL	9,000	3Q/83	0	0	0	4
	XMP 24	7	VL	11,000	3Q/83	0	0	0	
	M	7	VL	5,000	3Q/83	0	0	0	4
	TOTAL					36	12	48	14
Denelcor	HEP	6	L	1,400	02/82	5	1	6	7
Digital Equipment Corporation	2020	3	M	312	07/78	210	181	391	18
	2040/50	4	M	709	06/76	101	35	136	X
	2060	5	M	970	07/79	225	116	341	55
	PDP-6	4	M	400	10/64	1	0	1	X
	1040/50	4	M	693	10/67	44	20	64	X
	1060/70	5	M	860	06/72	77	38	115	X
	1080/90	6	L	1,358	06/75	340	199	539	170
	TOTAL					998	589	1,587	243
HIS	DPS 8/20	4	M	528	04/80	86	30	116	5
	DPS 8/44	4	M	827	01/80	93	68	161	5
	DPS 8/52	5	L	1,910	11/80	35	32	67	20
	DPS 8/62	5	L	2,253	12/81	8	1	9	5
	DPS 8/70	6	L	3,580	05/80	86	70	156	50
	DPS 88/81	7	VL	5,940	3Q/83	0	0	0	25
	DPS 88/82	7	VL	8,440	3Q/83	0	0	0	5
	Subtotal					308	201	509	115
	H 61/40	2	M	97	06/76	-	1,900	1,900	X
	H-61/58	2	M	108	06/74	40	613	653	X
	H-61/60	2	M	155	06/74	20	2,300	2,320	X
	H-Level 62	3	M	237	10/74	780	2,360	3,140	10
	DPS 4	3	M	82	07/80	-	2,305	2,305	700
	64/300	4	M	387	04/79	117	1,057	1,174	X
	H Level 64	4	M	568	10/74	214	980	1,194	X
	H-66/05/07	4	M	863	10/76	55	125	180	X
	H-66/10/17	5	L	1,411	06/75	30	81	111	X
	H-66/20/27	5	L	1,900	11/74	70	138	208	X
	H-66/40/60	6	L	3,678	10/74	85	156	241	X
	H-66/440/520	5	M	874	12/79	90	44	134	X
	H-66 DPS, BC	6	L	3,527	07/78	125	197	322	5
	H-66/80	7	VL	5,746	10/74	19	54	73	X
	H-68/80	7	VL	4,918	10/74	20	2	22	X
	H-68/DPS	7	VL	5,843	09/78	26	12	38	X
	Comshare/Xerox	5	M	612	06/79	18	0	18	X
	DPS7	4	M	480	--/81	50	271	321	300
	DPS 847	4	M	500	03/83	0	0	0	50
	DPS 849	4	M	800	03/83	0	0	0	30
	Subtotal					1,759	12,595	14,354	1,095
	G-50	2	M	82	08/70	65	900	965	X
	G-100	3	M	215	04/66	41	550	591	X
	G-200	4	M	425	04/61	32	10	42	X
	G-400	4	M	700	05/64	62	63	125	X
	G-600	6	L	3,400	04/65	12	10	22	X
	G-6023/25	5	L	1,490	11/73	11	15	26	X
	G-6030/40	5	L	1,900	06/71	14	72	86	X
	G-6050/60	6	L	3,250	07/71	37	47	84	X
	G-6070/80	6	L	4,890	07/71	18	28	46	X
	G-6180	7	VL	4,826	02/74	3	-	3	X
	Gamma-10	2	M	108	07/64	-	215	215	X
	Gamma-30	4	M	437	02/62	-	0	0	X
	Subtotal					295	1,910	2,205	0
	H 105/115	3	M	280	03/70	49	75	124	X
	H 110/120/200	3	M	285	01/66	98	74	172	X
	H-125	4	M	365	12/67	6	35	41	X
	H-2020/30	3	M	190	01/73	145	50	195	X
	H-1015/2015	4	M	805	02/71	14	12	26	X
	H-1200	4	M	629	02/66	75	24	99	X
	H-2040	4	M	595	04/72	50	38	88	X
	H-2050/60	4	M	920	04/72	80	52	132	X
	H-2200	4	M	862	01/66	33	9	42	X
	H-2070	5	L	1,600	05/72	15	1	16	X
	H-3200	5	L	1,220	02/70	35	18	53	X
	H-4200	5	L	1,920	09/68	3	1	4	X
	H-8200	6	L	2,950	02/69	5	4	9	X
	H-4/1400	4	M	560	12/61	5	4	9	X
	H-8/1800	5	L	1,500	12/60	3	1	4	X
	Subtotal					616	398	1,014	0
	TOTAL					2,978	15,104	18,082	1,210
IBM	System/38-3	2	M	140	07/80	830	740	1,570	X
	System/38-4	3	M	150	08/81	3,945	2,990	6,935	
	System/38-5	3	M	280	07/80	815	730	1,545	3,000
	System/38-7	4	M	380	06/82	150	150	300	
	System/38-8	4	M	400	07/83	0	0	0	
	Subtotal					5,740	4,610	10,350	3,000
	System/3-4	2	M	58	06/76	60	30	90	X
	System/3-6	2	M	75	12/70	290	74	364	X
	System/3-8	2	M	100	06/75	600	800	1,400	X
	System/3-10	2	M	115	01/70	2,565	854	3,419	X
	System/3-12	3	M	173	03/76	1,135	1,150	2,285	X
	System/3-15	3	M	320	03/74	2,445	1,227	3,672	X
	Subtotal					7,095	4,135	11,230	0
	4321	3	M	215	03/82	4,810	3,590	8,400	780
	4331-1	3	M	301	04/79				
	4331-11	4	M	370	03/82	1,450	1,170	2,620	900
	4331-2	4	M	573	08/80				

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IBM (Continued)	4341-9	4	M	210	02/83	0	0	0	
	4341-10	4	M	445	03/82	580	610	1,190	1,550
	4341-1	4	M	883	10/79	4,550	4,365	8,915	
	4341-11	5	M	810	03/82				
	4341-2	5	M	1,156	03/81	2,140	1,650	3,790	2,320
	4341-12	5	M	1,050	02/83				
	Subtotal					13,530	11,385	24,915	5,550
	3031	6	L	2,440	03/78	840	1,016	1,856	X
	3032	6	L	4,130	03/78	205	440	645	X
	3033S	6	L	3,380	01/81	145	85	230	X
	3033N	7	VL	3,856	01/80	300	380	680	X
	3033UAM	7	VL	7,290	03/78	970	635	1,605	X
	Subtotal					2,460	2,556	5,016	0
	3083E	6	L	3,200	2Q/83	0	0	0	
	3083B	6	L	4,800	1Q/83	0	0	0	1,400
	3083J	6	L	6,000	1Q/83	0	0	0	
	3081D	7	VL	7,300	10/81	600	224	824	
	3081G	7	VL	6,900	09/82	90	26	116	1,000
	3081K	7	VL	7,900	05/82	270	90	360	
	3084	7	VL	14,360	1Q/84	0	0	0	*
	Subtotal					960	340	1,300	2,400
	370/115	3	M	450	04/74	185	820	1,005	X
	370/125	4	M	620	06/73	210	557	767	X
	370/135	4	M	960	05/72	390	400	790	X
	370/138	4	M	935	11/76	790	1,300	2,090	X
	370/145	5	L	1,790	07/71	355	340	695	X
	370/148	5	L	1,595	03/77	880	850	1,730	X
	370/155	6	L	3,250	02/71	175	52	227	X
	370/158	6	L	5,025	05/73	1,095	764	1,859	X
	370/165	7	VL	6,100	06/71	35	6	41	X
	370/168	7	VL	9,050	07/73	500	190	690	X
	370/195	7	VL	12,450	03/71	7	3	10	X
	Subtotal					4,622	5,282	9,904	0
	360/20	3	M	136	12/65	365	152	517	X
	360/22	3	M	174	07/71	15	19	34	X
	360/25	3	M	391	10/68	20	81	101	X
	360/30	4	M	528	06/65	415	150	565	X
	360/44	4	M	880	07/66	25	14	39	X
	360/40	4	M	895	06/65	420	145	565	X
	360/50	5	L	1,550	08/65	190	68	258	X
	360/65	6	L	3,250	11/65	120	28	148	X
	360/67	7	VL		06/66				X
	360/75	7	VL	6,020	01/66	20	6	26	X
	360/85	7	VL		10/69				X
	360/9X	7	VL	9,150	11/67	1	1	2	X
	Subtotal					1,591	664	2,255	0
	1130	2	M	120	02/66	560	300	860	X
	1401	3	M	178	09/60	227	30	257	X
	1401G-H	2	M	106	05/64	6	1	7	X
	1410	4	M	800	11/61	4	1	5	X
	1440	3	M	227	04/63	12	5	17	X
	1460	4	M	460	10/63	5	1	6	X
	1620	3	M	129	09/60	20	11	31	X
	7010	5	L	1,200	10/63	2	1	3	X
	7030	7	L	-	05/61	-	-	-	X
	7040/44	5	L	1,439	06/63	1	1	2	X
	7070/74	5	L	1,299	03/60	7	-	7	X
	7080	6	L	2,800	08/61	4	-	4	X
	7090/94	6	L	3,350	08/60	6	-	6	X
	Subtotal					854	351	1,205	0
	TOTAL					36,852	29,323	66,175	10,950
IPL	4436	4	M	165	11/80	28	11	39	2
	4443	4	M	209	03/80	66	63	129	3
	4445	4	M	228	12/82	2	0	2	30
	4446	4	M	294	12/81	35	11	46	20
	4460	5	L	375	3Q/83	0	0	0	10
	4480	5	L	579	1Q/83	0	0	0	30
	TOTAL					131	85	216	95
Magnuson	M80/3	4	M	195	01/79	17	1	18	X
	M80/4	5	M	310	12/78	33	4	37	X
	M80/20	3	M	59	10/82	5	0	5	2
	M80/30	4	M	89	08/81	23	0	23	2
	M80/30E	4	M	112	12/81	1	0	1	X
	M80/31	4	M	134	06/80	74	7	81	8
	M80/32	4	M	176	06/80	119	12	131	8
	M80/41	4	M	163	02/82	2	0	2	1
	M80/42	4	M	183	03/81	69	7	76	7
	M80/43	5	M	238	03/81	61	6	67	8
	TOTAL					404	37	441	36
National Advanced Systems	AS/3	4	M	612	11/78	25	31	56	X
	AS/4	5	M	918	06/77	19	9	28	X
	AS/5	6	L	1,520	03/77	111	81	192	X
	AS/7020/30	5	M	820	01/79	-	9	9	X
	AS/7031	6	L	1,297	12/78	42	28	70	X
	AS/6	6	L	2,386	12/78	47	37	84	X
	AS/3000	4	M	460	01/80	39	14	53	X
	AS/5000	5	M	596	02/80	86	58	144	X
	AS/6600	5	M	465	10/82	3	5	8	120
	AS/7000	6	L	1,643	04/80	52	44	96	5
	AS/9000	7	VL	4,299	12/80	21	15	36	
	AS/9040	7	VL	2,000	10/82	2	-	2	
	AS/9050	7	VL	2,570	10/82	2	0	2	70
	AS/9060	7	VL	3,550	08/82	20	8	28	
	AS/9070	7	VL	4,150	12/82	1	-	1	
	AS/9080	7	VL	5,250	12/82	1	-	1	
	TOTAL					471	339	810	195
NCR	8270	2	M	87	11/79	434	660	1,094	20
	8350	2	M	154	07/77	72	5	77	X
	8370	3	M	269	07/78	9	-	9	X
	8410	2	M	150	02/79	189	259	448	X

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NCR (Continued)	8430	3	M	248	06/78	75	245	320	X
	8450	3	M	362	11/77	145	150	295	X
	8455	3	M	258	04/79	177	310	487	40
	8535II	3	M	220	04/82	10	18	28	70
	8545II	3	M	315	04/82	10	19	29	60
	8550	3	M	594	04/76	168	121	289	X
	8555	3	M	415	04/79	270	260	530	X
	8555II	3	M	400	04/82	68	80	148	240
	8560	4	M	699	11/77	40	25	65	X
	8565	4	M	549	04/79	95	156	251	X
	8565 II	4	M	440	04/82	20	25	45	80
	8570	4	M	894	05/76	88	81	169	X
	8575	4	M	684	04/79	99	73	172	X
	8580	5	L	1,627	12/78	5	10	15	X
	8585	5	L	1,381	08/79	31	53	84	X
	8650	6	L	1,000	11/81	0	15	15	X
	8670	6	L	1,300	05/82	0	7	7	X
	8575 II	5	M	514	05/82	10	12	22	60
	8585 II	5	M	549	05/82	5	6	11	30
	8595 II	5	M	696	05/82	5	6	11	25
	Subtotal					2,025	2,596	4,621	625
	8635	4	M	900	Q4/83	0	0	0	
	8645	5	L	1,420	Q4/83	0	0	0	
	8655	5	L	1,775	Q4/83	0	0	0	40
	8665	6	L	2,200	Q4/83	0	0	0	
	8675	6	L	2,660	Q4/83	0	0	0	
	8685	6	L	3,990	Q4/83	0	0	0	
	8695	6	L	4,990	Q4/83	0	0	0	
	Subtotal					0	0	0	40
	Century 50	2	M	80	02/71	120	133	253	X
	Century 75	2	M	114	07/76	25	36	61	X
	Century 100	3	M	157	09/68	90	80	170	X
	Century 101	3	M	201	10/72	270	350	620	X
	Century 151	3	M	289	02/75	103	122	225	X
	Century 200	4	M	367	09/69	60	60	120	X
	Century 201	4	M	590	09/69	77	85	162	X
	Century 251	4	M	1,005	11/73	14	18	32	X
	Century 300	5	L	1,340	02/72	45	51	96	X
	315/315/100	3	M	164	05/62	0	2	2	X
	315-RMC	4	M	500	09/65	0	1	1	X
	Subtotal					804	938	1,742	0
	TOTAL					2,829	3,534	6,363	665
Singer	System 10	2	M	120	10/70	764	0	764	X
Sperry Univac	III	4	M	1,124	08/62	45	8	53	X
	SS80/90	3	M	355	08/58	-	-	-	X
	418 I, II	4	M	450	06/63	28	27	55	X
	418 III	4	L	1,700	06/69	44	90	134	X
	491/492	5	M	1,150	12/61	1	3	4	X
	494	6	L	3,200	02/66	60	40	100	X
	1004	2	S	46	02/63	90	43	133	X
	1005	2	M	85	04/66	58	3	61	X
	1050	3	M	380	09/63	30	8	38	X
	Subtotal					356	222	578	0
	9200	2	M	98	06/67	536	310	846	X
	9300	3	M	212	09/67	439	260	699	X
	9400/80	4	M	530	05/69	125	260	385	X
	90/25	3	M	187	08/77	45	80	125	X
	90/30	3	M	402	02/75	755	1,310	2,065	X
	90/40	4	M	718	06/78	120	160	280	X
	90/60	4	L	1,111	01/74	115	132	247	X
	90/70/9700	5	L	1,275	08/72	5	18	23	X
	90/80	5	L	3,053	12/76	89	53	142	X
	System/80-3-4	2	M	136	12/80	487	670	1,157	200
	System/80-5-6	3	M	203	12/82	15	10	25	200
	System/80-8	3	M	413	--/83	0	0	0	40
	Subtotal					2,731	3,263	5,994	440
	1106	6	L	1,920	12/69	33	120	153	X
	1107	6	L	2,525	10/62	1	2	3	X
	1108	7	VL	3,750	09/65	140	53	193	X
	1110	7	L	6,250	06/72	18	42	60	X
	1100/10	5	L	1,965	04/76	75	143	218	X
	1100/20	5	L	2,674	04/75	6	18	24	X
	1100/40	6	L	4,493	07/75	37	33	70	X
	1100/60	5	L	1,821	03/80	310	720	1,030	470
	1100/80/81/82	6	L	5,447	03/77	180	158	338	15
	1100/83	7	VL	8,732	07/78	18	21	39	2
	1100/84	7	VL	10,300	11/78	41	21	62	5
	1100/91	6	L	6,367	1Q/84	-	-	-	*
	1100/92	6	L	10,631	1Q/84	-	-	-	*
	1100/93	7	VL	15,804	1Q/84	-	-	-	*
	1100/94	7	VL	17,980	1Q/84	-	-	-	*
	Subtotal					859	1,331	2,190	492
	301	4	M	295	10/60	4	-	4	X
	501	5	M	695	06/59	-	-	-	X
	3301	5	M	1,021	06/64	13	-	13	X
	Spectra 70/15	3	M	203	09/65	-	-	-	X
	Spectra 70/25	3	M	343	09/65	-	1	1	X
	Spectra 70/35	4	M	634	01/67	18	3	21	X
	Spectra 70/45	5	L	1,181	11/65	51	1	52	X
	Spectra 70/46	5	L	1,963	11/68	1	-	1	X
	Spectra 70/55	5	L	1,800	11/68	-	-	-	X
	Spectra 70/60	6	L	2,245	09/70	6	-	6	X
	Spectra 70/61	6	L	2,350	03/71	2	1	3	X
	Spectra 1600	3	M	180	01/69	13	-	13	X
	Spectra 70/2	4	M	620	07/71	3	-	3	X
	Spectra 70/3	4	M	1,040	10/71	5	-	5	X
	Spectra 70/6	6	L	1,680	10/71	17	-	17	X
	Spectra 70/7	6	L	2,140	10/71	12	2	14	X
	Subtotal					145	8	153	0
	TOTAL					4,091	4,824	8,915	932
Xerox	Sigma 5	4	M	585	08/67	66	7	73	X
	Sigma 6	4	M	1,030	11/70	18	12	30	X
	Sigma 7	5	L	1,170	12/66	25	4	29	X
	Sigma 8	4	M	920	09/71	0	1	1	X
	Sigma 9	6	L	2,400	11/71	70	27	97	X
	530	3	M	180	08/73	71	8	79	X
	550/560	4	M	631	11/74	21	2	23	X
	940	5	M	1,050	04/66	33	0	33	X
	9300	3	M	340	11/64	9	2	11	X
	TOTAL					313	63	376	X
GRAND TOTAL						57,180	58,513	115,693	

+++ The code to IDC's new classification: VL -- Very Large Scale System; L -- Large Scale System; M -- Medium Scale System; S -- Small Scale System.

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MINICOMPUTER CENSUS

IDC categorizes computers as "minicomputers" based primarily on the perceived marketplace for these products. By definition, minis are general-purpose in design, but are sold as tools as well as solutions; are available from makers in configurations ranging from board only to complete systems; are available to OEMs and are usually discounted in volume buys; are part of a family with low-end products generally in the $1,000-$25,000 price range; and have at least 4K RAM. Minicomputers range in size class from Microminis (M), which compete with high-end Microcomputers, to Traditional Minis (T), to Superminis (S), which frequently compete with small General-Purpose computers in interactive commercial applications. This census counts "Cumulative Number Shipped," making no attempt for retirements.

MINICOMPUTER CENSUS AS OF JANUARY 1, 1983

Name of Manufacturer	Computer Model	Word Length	Old Size Class	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Able Computer*	34 Magnum	16	T	S		21	14	10/81	10	0	10	X
	44 Magnum	16	S	S		21	16	07/81	40	10	50	X
								TOTAL	50	10	60	
Ampex	8MS/86, Different Series	16	T	S		7	12	06/78	1,900	1,400	3,300	NA
Apollo Computer	DN400	32	S	S		30	30	03/81	165	59	224	1,000
	DN420	32	S	S		33	32	03/81	216	71	287	1,000
	DN600	32	S	M		59	75	08/82	51	12	63	1,000
	DN300	32	S	S		13	20	02/83	0	0	0	1,000
								TOTAL	432	142	574	
Artonix*	PC-12/7	12	T	S		20	45	09/71	135	40	175	X
August Systems	Series 300	16	S	M		85	125	11/81	7	2	9	20
Auragen	4000	68000	S	M		138	138	4Q/82	0	0	0	NA
BTI	4000/15	16	T	S		30	35	01/76	341	8	349	X
	4000/25	16	T	S		42	49	01/76	251	12	263	X
	5000	16	S	S		30	39	09/78	3,500	123	3,623	350
	5000/ES	16	S	S		29	35	07/79	74	0	74	5
	8000	32	S	M		107	175	05/81	36	8	44	80
								TOTAL	4,202	151	4,353	
Bytronix	Series 500	16	T	S		3	4	09/80	170	280	450	NA
	Series 1000	16	T	S		5	5	12/77	200	600	800	NA
	Series 2000	16	T	S		8	8	12/78	75	115	190	X
	Series 3000	16	T	S		7	8	12/78	85	445	530	X
	Series 4000	16	T	S		7	5	03/81	150	300	450	NA
	Series 5000	16	T	S		10	7	09/81	30	15	45	NA
	Series 550	16	T	S		4	5	01/82	25	100	125	50
	Mikron 600 Series	16	T	S		5	7	10/82	75	25	100	750
								TOTAL	810	1,880	2,690	
Century Computer Corp.	C-200	M	T	S		5	7	02/71	150	0	150	X
Charles River Data	Universe 68/15	32	S	S		19	15	02/82	25	8	33	X
	Universe 68/17	32	S	S		21	19	04/82				
	Universe 68/27	32	S	S		17	14	08/82				
	Universe 68/37	32	S	S		18	15	08/82	10	3	13	NA
	Universe 68/47	32	S	S		22	18	08/82	5	2	7	NA
	Universe 68/80	32	S	S		39	31	1Q/81	10	0	10	NA
	Universe 68/05	32	S	S		12	12	12/82	2	0	2	NA
								TOTAL	52	13	65	
Cincinnati Milacron*	CIP/2000 Series	8, 10	T	S		4	17	07/69	4,676	804	5,480	X
	CIP/4000 Series	8, 10	T	S		4	17	12/76				
								TOTAL				
Compiler Systems Inc.*	CSI-16	16	T	S		11	20	11/70	80	10	90	X
	CSI-24	24	T	S		15	30	12/70	35	5	40	X
								TOTAL	115	15	130	
Computer Automation	108, 208, 808	M	T	S		5	11	04/68	280	30	310	X
	116	16	T	S		8	16	08/70	200	50	250	X
	216	16	T	S		8	20	07/69	350	45	395	X
	816	16	T	S		10	15	12/68	40	5	45	X
	Alpha-8, Naked Mini-8	M	T	S		2	3	05/72	5,002	1,340	6,342	X
	Alpha-16, Naked Mini 16	16	T	S		3	8	10/71				
	LSI 2/10, 20, 60	16	T	S		2	5	12/73	22,920	3,026	25,946	1,000
	LSI 2/40	16	T	S		8	18	04/80	300	200	500	1,000
	LSI 3/05	16	M	S		1	2	02/76	2,352	688	3,040	X
	LSI 4/10	16	M	S		1	8	06/77	8,000	3,934	11,934	NA
	LSI 4/30	16	T	S		2	8	06/77	2,404	656	3,060	1,000
	LSI 4/90	16	S	S		4	9	06/77	913	412	1,325	250
	LSI 4/95	16	S	S		10	24	01/80	129	32	161	150
	Scout N M 4/04	16	M	S		1	2	01/80	500	500	1,000	140
	Omnix	16	T	S		5	11	06/82	125	125	250	2,000
	NM 4/85	16	T	S		6	16	06/82	20	5	25	50
	NM 4/12	16	M	S		2	7	02/83	0	0	0	3,000
								TOTAL	43,535	11,048	54,583	
Computer Talk	CT-400	16	S	S		32	45	09/75	15	0	15	6
	CT-407	16	S	S		41	45	12/77	5	0	5	6
								TOTAL	20	0	20	
Control Data Corp.	1700/System 17/ Cyber 18	16+2	T	S		14	50	03/66	2,229	1,465	3,694	176
	Elbit-100	12	T	S		6	8	06/77	5	445	450	X
								TOTAL	2,234	1,910	4,144	
Data General	MP 100, 200	16	M	S		1	3	05/79	3,095	905	4,000	500
	Micronova	16	M	S		2	4	11/79	9,545	3,975	13,520	1,500
	Nova	16	T	S		6	12	02/69	800	400	1,200	X
	Nova 2 Series	16	T	S		3	10	10/73	7,280	2,720	10,000	X
	Nova 3/4	16	T	S		4	10	01/76	3,355	1,095	4,450	150
	Nova 3/12	16	T	S		5	18	01/76	15,570	5,030	20,600	700
	Nova 3/D	16	T	S		12	36	10/76	2,320	2,130	4,450	150
	Nova 4/C, S, X	16	T	S		3	20	03/79	12,100	7,900	20,000	5,000
	Nova 800/820	16	T	S		7	40	03/71	1,620	580	2,200	X
	Nova 830/840	16	S	S		16	44	07/73	520	280	800	X
	Nova 1200 Series	16	T	S		3	11	12/70	10,870	4,130	15,000	X
	Supernova SC	16	T	S		9	27	04/70	140	60	200	X
	Eclipse S100, 130 140	16	S	S		11	30	02/75	4,950	2,550	7,500	NA

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Name of Manufacturer	Computer Model	Word Length	Old Size Class	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Data General (continued)	Eclipse AP/130	16	S	S		30	50	09/78				
	Eclipse S200, 230	16	S	S		15	55	02/75	4,040	1,380	5,420	300
	Eclipse S/250	16	S	M		35	150	11/78	435	245	680	300
	Eclipse C/150	16	S	S		55	120	12/78	440	260	700	NA
	Eclipse C/300, 330	16	S	M		24	150	02/75	800	200	1,000	X
	Eclipse C/350	16	S	M		130	180	11/78	600	200	800	100
	Eclipse M/600	16	S	M		164	215	05/78	285	95	380	X
	Eclipse MV/6000	32	S	M		120	200	02/82	295	125	420	420
	Eclipse MV/8000	32	S	M		153	300	10/80	400	220	620	320
	Eclipse MV/4000	32	S	M		28	70	12/82	8	2	10	NA
	Eclipse MV/10000	32	S	M		240	510	20/83	0	0	0	NA
	DCC-112	12	T	S	a	3	12	08/70	900	500	1,400	X
	DCC-116	16	T	S	a	5	10	11/71	9,600	1,700	11,300	X
	DCC-416/616	16	T	S	a	3	7	09/75	180	20	200	X
	DCC-Model 5	16	T	S	a	3	6	02/76	90	10	100	X
								TOTAL	90,238	36,712	126,950	
Datamate Computer Systems*	DM-16	16	T	S		17	26	11/69	12	0	12	X
	DM-70	16	T	S		9	15	12/70	25	0	25	X
	ECP-18	18	T	S		14	16	11/66	21	0	21	X
								TOTAL	58	0	58	
Datum*	Enchancer E 1/16	16	T	S		8	15	03/76	15	3	18	X
Digiac Corp.*	3060		T	S		9	13	01/70	70	20	90	X
	3080	25	T	S		20	25	12/64	14	2	16	X
								TOTAL	84	22	106	
Digital Equipment	PDP-8/a, e, f, m	12	T	S		4	15	04/71	45,120	22,930	68,050	X
	PDP-8/i, l, s	12	T	S		8	27	05/65	5,765	3,685	9,450	X
	PDP-8/e (board level	12	MM	S		4	4	01/82	7,000	3,000	10,000	X
	PDP-9, 9L	18	T	S		35	50	12/66	290	160	450	X
	PDP-11/03, LSI-11/03	16	M	S		2	3	06/75	130,170	81,680	211,850	NA
	PDP-11/23, LSI-11/23	16	M	S		2	6	--/79				
	PDP-11/04, 05, 10, 15, 20	16	T	S		5	17	03/70	31,903	17,847	49,750	NA
	PDP-11/24	16	T	S		14	37	10/81	3,066	2,724	5,790	NA
	PDP-11/34, 35, 40	16	T	S		9	40	01/73	32,205	23,850	56,055	NA
	PDP-11/44	16	S	S		23	60	--/80	8,455	5,040	13,495	NA
	PDP-11/45, 50, 55	16	S	M		24	91	04/72	4,550	1,460	6,010	X
	PDP-11/60	16	S	M		26	75	06/77	1,172	1,078	2,250	NA
	PDP-11/70	16	S	M		60	175	07/75	8,055	3,545	11,600	NA
	VAX-11/730	32	S	M		47	65	06/82	350	300	650	NA
	VAX-11/750	32	S	M		47	100	--/80	2,195	1,645	3,840	NA
	VAX-11/780	32	S	M		128	305	05/78	3,815	2,535	6,350	NA
	VAX-11/782	32	S	M		395	500	20/82	35	25	60	NA
	PDP-12	12	T	S		13	46	04/69	510	225	735	X
	PDP-15 XVM	18	T	M		15	82	02/70	550	320	870	X
								TOTAL	278,206	169,049	447,255	
Digital Microsystems*	HEX-29	16	S	S		13	22	04/79	20	20	40	X
Digital Scientific Corp.	Meta-4/4000	16	S	M		29	90	04/70	140	15	155	X
	Meta-4/5010	16	S	S		21	40	10/78	5	0	5	X
	Meta 4/5020	16	T	M		28	85	04/78	48	0	48	4
	Meta 4/5030	16	S	M		59	150	06/79	15	1	16	10
								TOTAL	208	16	224	
Electronic Associates, Inc.	Pacer-100	16	T	S		15	40	05/72	198	161	359	NA
Formation	F/4000	32	S	M		71	134	08/81	35	20	55	25
Forward Technology	Gateway 300	68000	S	S		25	44	04/82	45	5	50	NA
	Gateway 500	68000	S	S		22	38	12/82	2	0	2	NA
								TOTAL	47	5	52	
Foto-Mem, Inc.*	Contour-100	M	T	S		6	20	04/70	25	0	25	X
Four-Phase Systems	Two Pi V/32	32	S	M		125	125	06/78	100	6	106	X
	System 311	32	S	M		160	265	02/81	155	15	170	NA
	System 312	32	S	M		210	320	12/81	52	8	60	NA
								TOTAL	307	29	336	
General Automation	18/30	16	S	S		18	50	07/69	780	210	990	X
	SPC-12	M	T	S		4	16	01/68	3,250	860	4,110	X
	SPC-16	16	T	S		5	25	05/70	7,540	2,125	9,665	X
	16/110, 220	16	M	S		1	7	12/75	8,100	2,710	10,810	NA
	16/230, 240	16	M	S		7	9	05/80				
	16/330, 340	16	T	S		3	10	01/76	405	140	545	X
	16/440, 460	16	S	S		12	30	07/75	2,070	625	2,695	X
	16/550	16	S	S		25	50	03/78	9	2	11	X
	470, 480	16	S	S		16	21	08/80	505	235	740	NA
	900	16	S	S		8	20	04/82	200	100	300	NA
	Zebra	68000	S	S		14	30	04/83	0	0	0	NA
								TOTAL	22,859	7,007	29,866	
GRI Computer*	909 Series	16	T	S		4	9	01/70	320	150	470	X
	99/10, 18	16	T	S		3	5	06/72	24	0	24	X
	99/30, 38	16	T	S		5	15	06/72	578	268	846	X
	99/40, 48	16	T	S		6	17	06/72	207	278	485	X
	99/50, 58	16	T	S		6	12	--/74	146	0	146	X
	99/52	16	T	S		8	17	--/76	7	3	10	X
								TOTAL	1,282	699	1,981	
GT&E*	IS/I	16	T	S		14	36	01/70	160	0	160	X
	IS/1000	16	T	S		6	10	06/72	4,000	0	4,000	X
								TOTAL	4,160	0	4,160	
Harris	6024/3	24	S	M		49	90	02/70	118	1	119	X
	Slash 4	24	S	M		24	110	08/73	243	18	261	X
	Slash 5	24	S	S		16	50	05/72	766	6	772	X
	Slash 6	24	S	M		20	70	12/76	323	10	333	X
	Slash 7	24	S	M		45	180	10/75	18	1	19	X
	Series 100	24	S	M		85	190	10/75	37	1	38	X
	Series 200	24	S	M		179	240	10/75	52	3	55	X
	Series 1X5	24	S	M		85	175	09/77	117	19	136	X
	Series 5X0	24	S	M		195	300	12/78	89	9	98	X
	H80	24	S	M		45	100	02/81	65	25	90	NA
	H100	24	S	M		45	150	01/71	166	14	180	NA
	H300	24/48	S	M		105	200	09/81	66	14	80	NA
	H500	24/48	S	M		100	250	01/79	265	70	335	NA
	H800	24/48	S	M		170	275	03/80	240	35	275	NA
	H800-2B	24/48	S	M		139	0	03/83	0	0	0	NA
	H800-2BP	24/48	S	M		164	0	03/83	0	0	0	NA
	H700	24/48	S	M		50	175	03/83	0	0	0	15
								TOTAL	2,565	226	2,791	

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Name of Manufacturer	Computer Model	Word Length	Old Size Class	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Hewlett-Packard	2100A	16	T	S		7	15	06/71	7,900	3,400	11,300	X
	2100S	16	T	S		16	36	08/73	1,825	1,425	3,250	X
	2114/15/16	16	T	S		9	29	11/66	2,495	1,145	3,640	X
	1000-M (MX-M, K)	16	T	S		2	25	06/74	8,336	6,507	14,843	NA
	1000-E (MX-E)	16	T	S		14	40	01/77	11,263	11,237	22,500	3,500
	1000-F	16	T	S		18	55	09/78	5,061	3,626	8,687	2,500
	1000-L, XL	16	T	S		2	10	06/79	1,320	1,130	2,450	NA
	1000-A (600, 700 900)	16	T	M		2	40	02/82	2,000	2,000	4,000	20,000
	3000 I, II	16	S	M		100	200	11/72	1,420	880	2,300	X
	3000 III	16	S	M		92	200	06/78	2,309	989	3,298	NA
	3000-33	16	S	M		58	135	01/79	728	312	1,040	NA
	3000-30	16	S	M		50	105	10/79	1,067	458	1,525	NA
	3000-40	16	S	S		40	52	11/81	981	420	1,401	NA
	3000-44	16	S	M		40	52	03/81	2,709	732	3,441	NA
	3000-64	16	S	M		200	300	01/82	332	138	470	NA
	9020	32	S	S		28	45	01/83	0	0	0	NA
	9030, 9040	32	S	S		28	45	01/83	0	0	0	NA
								TOTAL	49,746	34,399	84,145	
MIS	(GE) 30	M	T	S		7	35	05/69	225	50	275	X
	(GE) 3010/3012	16	T	M		13	90	05/70	25	1	26	X
	112	12	T	S		5	10	11/69	222	48	270	X
	116/316/416/516	16	T	M		8	62	10/66	2,405	1,295	3,700	X
	700 Series	16	T	M		16	65	06/72	2,114	1,811	3,925	X
	6/06	16	T	S		7	42	01/76	4,025	2,907	6,932	NA
	6/23	16	T	S		6	25	--/78				
	6/33	16	T	S		4	40	05/78				
	6/34	16	T	S		4	18	01/76				
	6/36	16	T	S		4	35	01/76				
	6/30	16	T	S		23	33	02/81				
	6/31	16	T	S		20	35	02/81				
	6/32	16	T	S		26	48	02/81				
	6/34	16	T	S		30	57	02/81				
	6/38	16	T	S		25	88	02/81				
	6/43	16	S	M		7	110	01/77	5,950	4,771	10,721	NA
	6/47	16	S	M		19	160	08/78				
	6/53	16	S	M		19	145	05/78				
	6/57	16	S	M		44	225	--/78				
	6/48	16	S	M		33	116	02/81				
	6/54	16	S	M		39	138	02/81				
	6/74	16	S	M		65	221	02/81				
	6/76	16	S	M		75	273	02/81				
	6/92	32	S	M		110	412	10/81	105	161	266	NA
	6/96	32	S	M		130	670	10/81				
								TOTAL	15,071	11,044	26,115	
IBM	Series 1	16	T	S		0	30	11/76	29,500	11,500	41,000	X
Information Technology*	4900/10	16	T	S		10	20	10/65	25	0	25	X
Intel	86/330	16	T	S		2	19	02/82	500	200	700	NA
	330A	16	T	S		3	20	08/82	200	100	300	NA
	380X	16	T	S		3	26	08/82	400	200	600	NA
								TOTAL	1,100	500	1,600	
Intellimac	IN/7000K	68000	S	S		28	35	04/82	20	5	25	50
	IN/7000M	68000	S	S		50	50	07/82	5	0	5	20
								TOTAL	25	5	30	
Intersil	LSI 8	LSI 8	T	S		3	7	07/80	23	25	48	NA
Keronix*	IDS-16/8, 10, 12	16	T	S		3	5	04/74	2,900	270	3,170	X
Lear Siegler*	VDP-410	16	T	S		4	4	10/78	100	50	150	X
Lockheed Electronics*	LEC-16	16	T	S		11	18	03/69	2,590	435	3,025	X
	Sue	16	T	S		6	11	09/72	2,878	472	3,350	X
								TOTAL	5,468	907	6,375	
Microdata	400	M	T	S		3	4	01/70	155	0	155	X
	800 Series	M	T	S		6	11	05/69	2,055	1,380	3,435	X
	1600	M	T	S		5	11	02/72	6,825	1,177	8,002	X
	3200/3230	16	S	S		8	14	03/74	115	110	225	X
	Micro One	M	M	S		1	3	11/74	800	120	920	X
								TOTAL	9,950	2,787	12,737	
Minicomp*	MD-708	M	T	S		5	7	08/70	50	0	50	X
Modular Computer Systems	Modcomp I	16	T	S		2	9	10/71	698	142	840	X
	Modcomp II	16	T	S		13	41	03/71	2,231	534	2,765	X
	Modcomp III	16	S	S		13	44	12/70	72	5	77	X
	Modcomp IV	16/32	S	M		48	100	05/74	339	130	469	X
	Classic 7810	16	T	S		8	11	05/79	510	60	570	NA
	Classic 7820	16/32	T	S		18	49	12/80	95	15	110	NA
	Classic 7830	16/32	S	S		35	47	09/79	315	41	356	NA
	Classic 7840	16/32	S	S		9	22	12/80	215	36	251	NA
	Classic 7860	16/32	S	S		61	49	01/78	180	59	239	NA
	Classic 7870	16/32	S	M		78	159	08/78	385	155	540	NA
	Classic II/25	16/32	S	S		19	43	06/82	25	15	40	NA
	Classic II/45	16/32	S	M		38	82	06/82	80	40	120	NA
	Classic II/55	16/32	S	M		51	130	07/82	5	0	5	NA
	Classic II/75	16/32	S	M		86	153	05/82	40	20	60	NA
								TOTAL	5,190	1,252	6,442	
Motorola*	MDP-1000	M	T	S		8	19	02/69	75	0	75	X
NCR	Tower 1632	68000	T	S		12	28	20/83	0	0	0	NA
New England Digital*	Able Series 40	16	T	S		8	10	06/77	100	25	125	X
	Able Series 60	16	T	S		10	12	06/78	70	10	85	X
								TOTAL	175	35	210	
Omnitec (BIT)*	480	M	T	S		6	17	12/66	195	3	198	X
	483	M	T	S		9	33	01/70	115	40	155	X
								TOTAL	310	43	353	

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Name of Manufacturer	Computer Model	Word Length	Old Size Class	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Perkin-Elmer	PC	8	T	S		4	11	09/70	210	77	287	X
	2, 3, 4, 5	16	T	S		9	21	05/67	614	153	767	X
	13, 15, 16, 18	16	T	S		15	33	09/69	14	14	28	X
	50, 55	16+1	T	S		7	33	04/72	133	40	173	X
	70	16	T	M		9	65	12/71	1,108	348	1,456	X
	74	16	T	S		3	34	02/73	300	56	356	X
	8085	16	T	S		15	50	07/72	70	18	88	X
	5/16	16	M	S		1	5	01/77	269	78	347	X
	6/16	16	T	S		6	15	01/76	1,966	770	2,736	NA
	7/16	16	T	S		3	18	02/74	3,732	840	4,572	0
	8/16	16	T	S		12	25	01/77	852	226	1,078	NA
	7/32	32	S	S		16	36	07/74	1,682	477	2,159	NA
	8/32	32	S	M		68	160	06/75	859	281	1,140	NA
	Series 16	16	T	S		7	22	04/79	852	255	1,107	NA
	3220	32	S	M		39	100	05/79	772	386	1,158	X
	3210	32	S	M		42	80	09/81	162	70	232	NA
	3230	32	S	M		64	150	03/81	285	141	426	NA
	3240	32	S	M		105	192	10/79	283	87	370	X
	3250	32	S	M		150	190	02/82	79	47	126	NA
	3210/A	32	S	S		25	35	09/81	83	19	102	NA
	3200MPS	32	S	M		185	300	2Q/83	0	0	0	NA
	Cadam	32	S	M		140	220	05/78	71	4	75	NA
								TOTAL	14,396	4,387	18,783	
Plessey Peripheral Systems	6600	11/23	S	S		20	25	04/83	0	0	0	250
	6700	11/23	S	S		20	25	04/83	0	0	0	250
								TOTAL	0	0	0	
Plexus Computers	P/25	16	T	S		15	22	06/82	100	70	170	100
	P/40	16	S	S		38	41	09/81	70	32	102	100
	P/35	16/32	S	S		18	25	05/83	0	0	0	100
	P/60	16/32	S	S		43	47	05/83	0	0	0	100
								TOTAL	170	102	272	
Point 4 Data	Point 4 Mark 5	16	T	S		5	9	03/79	3,000	850	3,850	700
	Point 4 Mark 3	16	T	S		3	5	05/81	615	230	845	150
	Point 4 Mark 8	16	T	S		7	15	11/81	120	30	150	40
								TOTAL	3,735	1,110	4,845	
Polycomputers	301C	16	S	S		30	21	08/82	25	10	35	NA
	903A	16	S	S		67	40	11/82	4	0	4	NA
	1701A	16	S	S		100	60	2Q/83	0	0	0	NA
								TOTAL	29	10	39	
Prime Computer	100	16	T	S		6	12	04/73	310	560	870	X
	200	16	T	S		7	22	11/72	430	210	640	X
	300	16	S	S		12	58	09/73	460	350	810	X
	400	16	S	M		62	207	06/76	220	180	400	X
	500	16	S	M		126	330	06/76	80	40	120	X
	150 II	32	S	M		54	65	06/80	20	60	80	X
	250 II	32	S	M		50	75	06/80	309	730	1,039	NA
	350	16/32	S	M		31	116	07/78	200	120	320	X
	450	16/32	S	M		50	75	02/79	300	120	420	X
	550	16/32	S	M		70	105	02/79	1,315	800	2,115	X
	550 II	16/32	S	M		75	110	07/81	545	255	800	NA
	650	16/32	S	M		95	165	02/79	128	80	208	X
	750	32	S	M		130	200	07/79	985	353	1,338	NA
	850	32	S	M		275	370	07/81	105	40	145	NA
	2250	32	S	S		40	50	10/82	90	80	170	NA
								TOTAL	5,497	3,978	9,475	
Q1 Corporation	68000 Bay System	68000	S	S		15	30	08/83	0	0	0	10
Raytheon	703	16	T	S		13	23	10/66	179	33	212	X
	704	16	T	S		10	18	03/70	700	200	900	X
	706	16	T	S		19	30	05/69	75	17	92	X
	RDS 500	16	S	S		17	21	12/73	1,332	287	1,619	125
	RDS 550	16	S	S		14	14	10/80	446	0	446	150
								TOTAL	2,732	537	3,269	
Redcor Corp.*	RC 70	16+2	T	S		15	30	07/68	100	40	140	X
Ridge Computers	Ridge Thirty Two	32	S	S		55	60	08/82	1	0	1	80
SCI Systems	Venus 1000	16	M	S		4	8	--/83	0	0	0	NA
	Mercury 3	16	T	S		6	13	--/78	710	80	790	NA
	Mercury 2	16	T	S		5	12	--/83	0	0	0	NA
								TOTAL	710	80	790	
Sperry	5201	16	T	S		0	13	09/68	330	170	500	X
	620/a	16	T	M		0	75	12/65	120	30	150	X
	520/f, f-100	16	T	S		10	23	06/70	470	220	690	X
	620i	16/18	T	S		10	20	12/65	920	380	1,300	X
	620/L+100C	16	T	S		5	12	02/71	720	320	1,040	X
	620/L-100	16	T	S		6	14	06/72	1,095	554	1,649	X
	A620/i, R622/i	16/18	T	S		15	29	06/69	185	80	265	X
	V-72	16	T	S		10	45	02/74	1,130	453	1,583	X
	V-73	16	S	S		16	45	11/72	1,190	530	1,720	X
	V-74	L	S	M		40	80	05/74	210	90	300	X
	V-75	16	S	M		39	80	08/75	120	50	170	X
	V-76	16	S	S		8	16	01/76	754	329	1,083	X
	V-77-200	16	M	S		2	5	01/77	977	371	1,348	X
	V-77-400	16	T	S		5	28	12/76	326	235	561	X
	V-77-500	16	S	S		30	60	03/81	100	100	200	NA
	V-77-600	16	S	M		18	65	03/77	1,273	511	1,784	NA
	V-77-700	16	S	M		34	90	03/81	52	72	124	NA
	V-77-800	16	S	M		22	95	03/79	712	490	1,202	NA
								TOTAL	10,684	4,985	15,669	
Stratus	Stratus/32	32	S	M		12	200	02/82	28	7	35	75
Synapse	N+1	68000	S	M		0	340	4Q/82	0	0	0	NA
Systems Computer Corp.*	1000	M	T	S		1	4	01/71	400	200	600	X
Systems Engineering	32/30, 35	32	S	M		30	80	09/76	180	60	240	X
	32/55, 57	32	S	M		50	125	08/75	570	175	745	X
	32/75, 77	32	S	M		70	150	03/78	1,000	243	1,243	125
	32/27	32	S	S		25	60	02/81	638	160	798	800
	32/87	32	S	M		250	350	11/81	177	44	221	275
								TOTAL	2,565	682	3,247	

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Tandem	Non Stop, Non Stop II	16	S	M		95	170	05/76	3,327	1,114	4,441	NA
Telefile	TCP-16/5	16	T	S		12	15	09/77	205	90	295	50
Texas Instruments	960-A/B	16	T	S		14	30	12/71	4,000	1,900	5,900	X
	980-A/B	16	S	S		17	40	10/72	4,050	1,800	5,850	X
	990/4	16	M	S		1	8	06/76	8,205	2,935	11,140	NA
	990/10	16	T	S		15	23	03/76	20,315	9,165	29,480	NA
	990/5	16	M	S		5	10	03/79	6,985	2,965	9,950	NA
	990/12	16	S	S		28	52	11/79	3,830	2,575	6,405	NA
	BS200	16	M	S		5	9	08/82	275	200	475	NA
								TOTAL	47,660	21,540	69,200	
Three Rivers Computer	Perq	TRC	S	S		27	29	08/80	300	600	900	NA
	System D/L	TRC	S	S		35	35	03/83	0	0	0	NA
								TOTAL	300	600	900	
Unicom, Inc.*	CP-8	M	T	S		3	8	02/70	343	165	508	X
Unicomp*	Comp-16	16	T	S		11	29	06/70	26	0	26	X
	Comp-18	18	T	S		12	38	08/70	38	0	38	X
								TOTAL	64	0	64	
Westinghouse Electric	P-50	14	T	S		16	23	08/64	182	40	222	X
	P-2000	16	T	S		10	27	08/69	111	97	208	4
	2500F	16	T	S		10	30	11/71	344	134	478	5
								TOTAL	637	271	908	
Xerox*	CE-16, 16A	16	T	S		8	23	06/69	35	0	35	X
	Sigma 2	16	T	M		24	125	12/66	5	0	5	X
								TOTAL	40	0	40	
								TOTAL	677,928	337,092	1,015,020	

Notes: a Digital Computer Controls was acquired by Data General in early 1977.
b Two Pi Corp was purchased by Four-Phase Systems, Inc. during 1980; Four-Phase was acquired by Motorola during 1982.
c Corporate name changed from Educational Data Systems, March 1, 1980.
* Not currently active in manufacturing or marketing Minicomputers.
NA Data is not available.
X Model is not in new production.

+++ The code to IDC's new classifications:

M -- Medium Scale System;

S -- Small Scale System.

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SMALL BUSINESS COMPUTER CENSUS

The categorization of certain computers as "small business computers" is based on marketplace definitions as perceived by IDC. SBCs are those small general-purpose computers marketed to smaller businesses, first-time users, and increasingly to small units of large organizations. They include offerings from the major mainframers (such as IBM's System/32 and /34); from the minimakers, but aimed at commercial first-time users (such as DEC's Datasystem/300); from firms that manufacture only SBCs (such as Quantel); and from companies that market systems assembled from others' minicomputers (i.e., systems houses).

SMALL BUSINESS COMPUTER CENSUS AS OF JANUARY 1, 1983

Name of Manufacturer	Computer Model	Processor Model	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
A.M. Jacquard Systems	J100	J100	S		14	46	08/75	2,000	1,500	3,500	50
	J200	J100	S		22	55	09/82	10	10	20	20
	J300	J300	S		25	75	09/82	300	50	350	300
	J600	A.M. Jacquard	S		19	22	--/83	0	0	0	400
							TOTAL	2,310	1,560	3,870	
A.O. Smith*	Mesa Two	Nova 3	**		58	58	05/77	10	0	10	X
Advanced Information Design*	System 3000	Interdata X/16	S		24	39	03/75	41	0	41	X
Anderson Jacobson*	1400	AJ1400	S	a	16	22	01/70	260	15	275	X
	1520 Series	AJ1500	S		19	21	07/77	200	25	225	X
	1560 Series	AJ1500	S		30	35	07/77	60	3	63	X
							TOTAL	520	43	563	
Applied Computer Systems*	Smart Alec	8080-A	S		12	13	01/77	47	17	64	X
Applied Data Communications*	Event	Event 2000	S		13	20	02/77	156	12	168	X
	Clinic 2	Event 2000	S		19	23	06/79	20	0	20	X
	Event 3000	8080-A	S		22	22	12/79	11	0	11	X
	League Master	8080-A	S		23	23	--/80	2	0	2	X
							TOTAL	189	12	201	
Applied Data Processing, Inc.*	Resource 50	Nova 3/4	**		31	52	09/79	1	0	1	X
	Resource 100	Nova 3/12	**		41	72	06/79	16	0	16	X
							TOTAL	17	0	17	
Applied Digital Data Systems	Adds/Vantage	8080	**		11	14	07/76	550	400	950	X
	Mentor 3000	Z8001	S		25	28	12/82	6	2	8	200
	Mentor 4000	Z8001	S		33	45	08/81	398	112	510	450
	Mentor 5150	Z8001	S		65	75	12/82	2	0	2	75
	Mentor 5300	Z8001	M		79	99	12/82	3	0	3	75
							TOTAL	959	514	1,473	
Astrocom*	Series 760	Z80	PC		16	20	06/79	30	0	30	X
Ball Computer Products*	DASL	Nova 2/10	**		38	40	06/75	3	0	3	X
Basic Four Corporation	200	BFC1340	S		25	29	02/78	600	800	1,400	X
	350	BFC1300, Microdata	S	b	34	34	09/71	500	576	1,076	X
	400	BFC1300, Microdata	S	b	37	45	09/71	1,712	1,739	3,451	X
	410	BFC1300	S	b	33	41	10/78	1,500	1,850	3,350	X
	500	BFC1300, Microdata	S	b	39	50	07/72	100	82	182	X
	600	BFC1300, Microdata	S		51	65	03/75	300	308	608	X
	610	BFC1310	S		51	66	01/78	1,450	1,250	2,700	X
	700	BFC1320	M		115	130	--/77	109	99	208	X
	730	BFC1350	M		95	124	06/78	530	600	1,130	X
	210	BFC1345	S		25	29	07/81	550	600	1,150	NA
	310	BFC1350	S		55	60	01/82	80	70	150	NA
	510	BFC1345	S		44	61	--/80	530	500	1,030	NA
	710	BFC1350	S		69	72	01/82	100	110	210	NA
	810	BFC Basic 4	M		117	150	40/82	22	114	136	NA
							TOTAL	8,083	8,698	16,781	
Basic Time*	B-100	Digidyne	S		16	16	07/79	130	10	140	X
	B-200	Digidyne	S		20	20	11/79	35	5	40	X
							TOTAL	165	15	180	
Billings Computer Co.	BC-104	BC-104	PC		12	22	--/77	400	0	400	X
BRD, Inc.*	Dolphin	6800	S		18	20	06/77	400	30	430	X
	Porpoise	6800	PC		10	13	01/78	160	5	165	X
							TOTAL	560	35	595	
Briareus	SYS-200	EDS Point 4	**		20	40	01/76	160	0	160	NA
	SYS-100	EDS Point 4	**		29	35	03/82	10	0	10	10
	SYS-25	Microtech	**		20	27	12/82	5	0	5	25
							TOTAL	175	0	175	
Burroughs	B80	B80	S		17	29	11/76	8,340	13,560	21,900	NA
	B90	B90	S		18	33	12/79				
	B700	B700	S	c	26	68	03/73	1,800	1,500	3,300	NA
	B800	B800	S		35	51	05/77	5,712	3,208	8,920	NA
	B900	B900	S		61	76	08/80	1,655	745	2,400	NA
							TOTAL	17,507	19,013	36,520	
Business Systems Products*	Advisor	C.A. Syfa	**		42	50	07/76	111	0	111	X
Cado	System 20	8080	S		12	16	04/76	430	202	632	X
	20/4, 20/24	8085	S		16	27	04/78	3,061	1,403	4,464	NA
	40/4, 40/44	8085	S		20	37	05/78	431	21	452	X
	20/2, 20/22	8085	S		15	16	06/79	437	228	665	X
	20/28	Dual 8085	S		23	30	05/80	573	227	800	NA
	System 40, 1000	8080	S		18	20	03/77	568	114	682	X
	CAT I	8085	S		10	12	05/80	826	598	1,424	NA
	CAT II	8085	S		15	17	08/80	953	548	1,501	NA
	CAT III	8085	S		9	13	06/82	315	193	508	NA
							TOTAL	7,594	3,534	11,128	NA
Cascade Data Inc.*	80/20, 30, 40	Concept	S		28	42	01/70	50	0	50	X
	Concept II	Concept	S		27	35	06/75				
	Concept III, IV	Concept	S		17	29	01/78	334	15	349	X
							TOTAL	384	15	399	

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Centurion Computer Corp.	Centurion IA	CC-205	S	d	18	19	--/77	60	0	60	X
	Centurion IIA	CC-205	S		27	30	--/75	95	0	95	X
	Centurion Series 100	CC-205	S		15	15	--/79	124	20	144	X
	Centurion III	CPU 5	S		30	36	--/74	604	46	650	X
	Centurion Series 200	CPU 5	S		27	27	--/79	130	34	164	X
	Centurion Series 6000	CPU 6	S		33	40	10/79	225	50	275	NA
	Centurion Series 5200	CPU 6	S		20	21	05/82	40	6	46	NA
	Centurion Series 5300	CPU 6	S		22	24	05/82	40	6	46	NA
	Micro Plus Series	CPU 5, CPU 6	S		10	11	01/82	365	45	410	NA
							TOTAL	1,683	207	1,890	
Century Computer Corp.	CC200	CC200	S		27	49	03/75	1,661	1,600	3,261	400
	Opus III	CC200	PC		15	22	02/71	560	110	670	X
	BPM	CC200	S		19	50	12/80	131	0	131	X
							TOTAL	2,352	1,710	4,062	
Cetec (Automated Business Concepts)	Mesa Two	Nova 4	**	e	50	73	04/78	70	0	70	X
	Maps	Digidyne	**		40	46	02/82	65	0	65	25
							TOTAL	135	0	135	
CIE Systems	680/20	68000	S		9	14	07/82	22	0	22	NA
	680/40	68000	S		19	24	06/82	4	0	4	NA
	680/30	68000	S		10	16	11/82	4	0	4	NA
							TOTAL	30	0	30	
Cincinnati Milacron*	George 40, 60, 70, 80	CIP/2200B, 4400	S		16	35	--/74	670	150	820	X
Clary Data Systems*	404	Clary	PC		6	30	01/70	100	32	132	X
Complete Computer Corp.	10, 11, 12	Nova 3/12, 4X	**		30	44	03/74	46	0	46	15
	14, 16, 18	Nova 3/12, 4X	**		45	58	10/76	29	0	29	X
	20, 22, 24	Nova 3/12, 4X	**		58	74	09/77	8	0	8	X
	40, 44	Nova 4X	**		48	65	01/80	24	0	24	X
							TOTAL	107	0	107	
Compucorp*	402	Compucorp 3000	PC		13	15	01/76	15	455	470	X
	450	Compucorp 3000	PC		20	22	04/76	40	115	155	X
							TOTAL	55	570	625	
Computer Hardware Inc.*	2120	CHI	S		15	50	05/75	10	1	11	X
	2130C	CHIC	S		32	75	07/74	350	4	354	X
	2130D	CHID	M		44	120	01/78	10	0	10	X
	3230	CHI	S		15	50	06/76	100	0	100	X
	4210	CHI	S		13	13	09/77	4	0	4	X
	4250	CHI	S		37	45	06/78	7	0	7	X
							TOTAL	481	5	486	
Computer Interactions Inc.*	Compo II-8	PDP-8/e, f, m	**		31	50	11/72	600	0	600	X
	Compo II-11	PDP-11	**		37	53	06/75	440	0	440	X
	Word Pro II	PDP-8, Nova, HP	**		13	17	02/77	820	0	820	X
							TOTAL	1,860	0	1,860	
CYB Systems	Multibox	68000	S		10	22	04/82	110	0	110	900
Data General	CS/5	Micro Nova	**		6	11	3Q/82	400	100	500	X
	CS/10	Micro Nova	**		11	13	11/80	1,400	900	2,300	X
	CS/20	Micro Nova	**		11	20	07/78	180	120	300	X
	CS/30	Micro Nova	**		21	25	08/79	780	220	1,000	500
	CS/40	Nova 3/12	**		33	40	10/77	600	400	1,000	1,100
	CS/50, CB/50	Micro Nova 45, 4X	**		32	65	--/80	675	225	900	X
	CS/60	Eclipse	**		40	75	07/78	360	115	475	X
	CS/70	Eclipse	**		36	43	11/80	200	125	325	X
	CS/100	Eclipse	**		18	24	3Q/82	115	35	150	X
	CS/200	Eclipse	**		25	30	3Q/82				
	Design Data EC300	Eclipse C/300	**	f	60	150	03/76	50	10	60	75
	Design Data N312	Nova 3/12	**	f	31	75	08/75	90	10	100	125
	Synergist 1500	Micro Nova	**		8	24	--/76	15	5	20	X
	Synergist 1550	Micro Nova	**		14	21	07/78	35	5	40	X
	Synergist 2500	Nova 3/12	**		27	40	--/76	150	10	160	X
	Synergist 3700	Nova 3/D	**		40	60	--/76	15	5	20	X
							TOTAL	5,065	2,285	7,350	
Decision Data Computer*	System/4	System/4	S		23	37	08/76	15	0	15	X
Diablo Systems Inc.*	3200	8080	S	g	19	23	01/77	3,000	3,200	6,200	X
Digital Equipment Corp.	Datasystem 300	PDP-8, PDP-11	**		14	30	--/72	9,400	6,000	15,400	400
	Datasystem 500	PDP-11	**		58	115	--/72	1,975	1,900	3,875	X
	DECstation 78/88	PDP-8	**		8	11	03/78	1,775	1,150	2,925	X
	DECstation 78/88	PDP-8A	**		12	15	03/78				
	Datasystem 700	VAX 11/750	**		NA	138	--/81	142	0	142	X
	Datasystem 700	VAX 11/780	**		NA	300	--/81	67	0	67	X
							TOTAL	13,359	9,050	22,409	
Digital Systems	Galaxy/5	Galaxy/5	M		87	110	01/76	26	0	26	20
	Galaxy/3	Galaxy/3	S		47	60	01/80	10	0	10	10
							TOTAL	36	0	36	
Dimis, Inc.	Total 100	Modcomp II, Classic	**		110	155	06/74	56	0	56	12
Display Data Corp.	Series 8000	Microdata 1600/30	S		33	36	05/82	148	2	150	75
	Insight, ELS Sys., Insight 80	Microdata 1600/30	S		23	26	01/74	1,522	15	1,537	60
							TOTAL	1,670	17	1,687	
DTC*	Task Master	8080	S		17	19	09/78	25	90	115	X
Evolution Computer	Series I	ETI	M	h	65	77	11/73	206	28	234	X
	Series II	ETI	M		88	97	10/77	180	10	190	X
	240, 260, 280	ETI	S		37	63	02/81	225	27	252	200
							TOTAL	611	65	676	

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Financial Computer Corporation*	System 111/6	System 111	S		19	25	09/77	28	0	28	X
	System 111/8	System 111	S		23	32	09/77	22	0	22	X
	System 111/10	System 111	S		30	45	01/75	440	55	495	X
							TOTAL	490	55	545	
General Automation	OM-130/2	SPC-16/45	**		28	28	12/74	150	350	500	X
	OM-130	SPC-16/45	**		30	38	12/74	80	180	260	X
	OM-140	SPC-16/65	**		48	80	01/75	7	18	25	X
	440-DS	GA 16/440	**		38	70	01/76	35	65	100	X
	460-DS	GA 16/460	**		35	80	11/78	10	30	40	X
	Instacode	GA 16/230	**		34	34	06/80	8	6	14	X
							TOTAL	290	649	939	
General Information*	GIS-350 Able	PDP-11/34	**		36	40	01/76	20	0	20	X
General Robotics	Gemini Series	LSI-11	**		5	8	07/76	350	650	1,000	500
	Tristar Series	LSI-11	**		11	22	07/76	175	325	500	X
	Pegasus Series	LSI-11	**		8	13	09/77	229	423	652	200
	Scorpio	LSI-11	**		3	8	07/81	105	195	300	400
							TOTAL	859	1,593	2,452	
GRI Computer*	System 99	GRI 99/50	**		30	35	11/74	196	88	284	X
	System 99/E	GRI 99/52	**		43	50	11/77	35	15	50	X
	Grip	GRI	S		30	30	11/78	25	0	25	X
							TOTAL	256	103	359	
Hewlett-Packard	HP 250	HP 250	S		16	28	09/78	1,900	2,400	4,300	NA
	HP 300	HP 300	S		30	58	09/78	220	310	530	NA
							TOTAL	2,120	2,710	4,830	
IBM	System/32	IBM S/32	S		27	42	03/75	4,400	4,250	8,650	X
	System/34	IBM S/34	S		30	64	12/77	58,000	34,000	92,000	NA
	System/36	IBM	M		30	56	10/83	0	0	0	NA
							TOTAL	62,400	38,250	100,650	
ICL (U.S. Only)	System 25	ICL	S		35	55	01/82	8	-	8	1,000
	DBS 20	ICL	S		7	25	03/82	75	-	75	3,000
							TOTAL	83	-	83	
Incomnet	Lotus Basic	Z80001	S		20	35	07/83	0	0	0	20
	Lotus Executive	Z80001	S		30	40	09/83	0	0	0	15
	Lotus Advanced	Z80001	S		50	70	05/83	0	0	0	35
							TOTAL	0	0	0	
Indep	Apogee III	Z80A	S		12	20	2Q/82	10	0	10	10
Independent Business Systems	Betasystem 2	Z80A	S		5	10	11/80	160	40	200	600
Infotecs	IMP	IM 6100	PC		10	15	09/77	855	128	983	NA
	CC2	IM 6100	S		10	25	01/80	1,500	193	1,693	NA
							TOTAL	2,355	321	2,676	
Interactive Systems Technology	IST-86	8086	S		13	14	10/82	50	0	50	2,000
International Computing*	System 95/99	Nova 2/10	**		25	35	10/72	9	0	9	X
Kalbro Computer Services*	BDS 500	Microdata 1600	**		30	48	03/77	41	0	41	X
	BDS 1000	Microdata 1600	**		35	55	06/72	82	0	82	X
	BDS 2000	Microdata 1600	**		43	73	10/73	94	0	94	X
	BDS 4000	Microdata 1600	**		51	85	10/79	8	0	8	X
							TOTAL	225	0	225	
Keydata	Unity Series	Nova 3/4, 3/12, 30	**	i	48	80	04/79	35	1	36	X
Lockheed Electronics*	System III	Sue	**		30	50	01/73	465	130	595	X
Logical Machine	Adam I, Adam II, Adam	Adam	S		25	29	04/75	580	850	1,430	NA
	Tina	Tina	S		18	20	12/78	500	1,200	1,700	NA
	David	Logical	S		6	6	--/80	400	1,550	1,950	NA
	Goliath	Goliath	S		28	40	11/80	60	120	180	NA
							TOTAL	1,540	3,720	5,260	
Martin Wolfe, Inc.*	Mesa Two 7000	DCC-116	**		54	81	12/71	140	0	140	X
	Mesa Two 4000	DCC-116	**		62	93	02/76	3	0	3	X
							TOTAL	143	0	143	
MDS Qantel	210, 110	Q29	S	j	12	17	11/77	215	690	905	X
	800, 900	Q7	S		28	29	05/75	85	62	147	X
	950	Q7	S		28	33	11/75	600	240	840	X
	960	Q7.5	S		30	35	11/76	300	100	400	X
	970	Q29B	S		36	40	01/79	250	150	400	X
	1200	Q7	S		42	59	11/75	200	20	220	X
	1300	Q7.5	S		42	59	11/75	40	15	55	X
	1400-2	Q7.5	S		44	70	05/77	360	170	530	X
	1450-2	Q29B	M		45	80	01/79	200	50	250	X
	200 Series	Q29B	S		30	57	03/80	1,399	744	2,143	X
	300 Series	Q29B	M		50	80	03/80	471	97	568	X
	20 Series	Q29B	S		23	30	11/81	520	180	700	600
	40 Series	Q30	M		50	80	10/82	110	10	120	500
	64 Series	Q64	M		150	225	04/83	0	0	0	100
	L	Q29B	S		14	18	04/83	0	0	0	900
							TOTAL	4,750	2,528	7,278	
Micro Business Applications	Micron 440	Z80, 8085	S		15	19	12/81	2	0	2	NA
	Micron 740	8085	PC		25	30	--/78	29	0	29	X
	Micron 840	Z80, 8085	S		25	33	05/81	6	0	6	NA
							TOTAL	37	0	37	
Microdata	Reality	M.data 1600	**		32	60	12/73	2,785	518	3,303	NA
	Reality 2000	M.data 1600	**		32	37	06/79	121	11	132	NA
	Reality 4000	M.data 1600	**		38	41	06/79	651	92	743	NA
	Reality 6000	M.data 1600	**		51	60	06/79	1,685	117	1,802	NA
	Reality 8000	M.data 1600	**		89	100	09/80	424	46	470	NA
	Sequel	M.data	**		163	175	12/81	91	77	168	NA
							TOTAL	5,757	861	6,618	

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Micromation	Mariner (Z80A)	Z-80A	S		10	18	01/80	700	1,200	1,900	2,400
	Mariner (8088)	8088	S		10	18	01/83	0	0	0	750
							TOTAL	700	1,200	1,900	
Microstar*	Microstar I, II	Z80	PC		13	18	12/78	5	0	5	X
Microtech Business Systems	System 50, 100, 200, 300, 400	Point 4	**		15	35	--/79	800	0	800	200
	M1 Series	M1	S		12	24	12/82	50	0	50	1,100
							TOTAL	850	0	850	
Midwest Scientific*	MSI-6800AW	6800	S		8	15	05/79	1,000	850	1,850	X
Mini-Computer Systems	Micos 100	Nova 3/4	**		20	25	08/77	200	225	425	35
	Micos 200	Nova 3/12	**		35	60	--/73	1,100	500	1,600	100
	Micos 300	Dual Nova 3/12	**		100	140	01/79	25	4	29	40
	Micos 75	Nova 3/4	**		26	26	09/79	18	16	34	X
	Micos 85	Nova 3/4	**		36	41	--/80	22	28	50	X
	Micos 250	Micos 250 CPU	S		50	75	12/82	4	0	4	25
	Micos 350	Micos 350 CPU	M		115	165	08/82	6	0	6	25
							TOTAL	1,375	773	2,148	
Minicom Systems	P/4	Point 4	**		8	10	--/82	30	14	44	100
	D128 Series	Minicom	S		8	10	01/81	270	30	300	200
	32/64	Point 4	**		16	20	05/81	135	0	135	X
							TOTAL	435	44	479	
Minuteman Computer Corporation	1774	Nova 3/4, 4/5	**		29	40	11/71	80	0	80	X
	1775	Nova 3/12, 4/16	**		25	35	03/72	60	0	60	12
	1776	Nova 3/12, 4/16	**		30	45	03/72	75	0	75	17
	1776/A	Nova 3/12, 4/16	**		35	65	05/77	70	0	70	20
							TOTAL	285	0	285	
Molecular Computers	Supermicro 32X	Z80B	S		19	19	06/83	0	0	0	NA
	Supermicro 64X	Z80B	S		23	23	06/83	0	0	0	NA
							TOTAL	0	0	0	
Mylee Digital Sciences	3000 Series	Mylee 3G	S		35	56	05/76	284	0	284	70
NCR	8130, 40, 50	NCR	S		15	23	02/77	937	3,600	4,537	NA
	9010	NCR	S		14	18	04/81	176	1,000	1,176	NA
	9020	NCR	S		25	28	03/81	1,180	2,700	3,880	NA
	9040	NCR	M		107	120	05/81	375	1,030	1,405	NA
	9050	NCR	M		135	150	05/81	81	125	206	NA
	8200, 30/31, 50/51	NCR	S		27	55	09/74	5,950	6,900	12,850	X
	9300		M		24	59	20/83	0	0	0	NA
							TOTAL	8,699	15,355	24,054	
NEC Information Systems (U.S. Only)	210	NEC	S		11	17	06/79	107	-	107	NA
	230	NEC	S		11	25	06/79	1,450	-	1,450	NA
	250	NEC	S		25	45	06/79	470	-	470	NA
	270	NEC	S		27	59	11/81	207	-	207	NA
							TOTAL	2,234	-	2,234	
Nixdorf (U.S. Only)	8870/1, /3	8013, 8015	S		22	72	--/78	750	-	750	200
Norfield Datasystems*	Nova System	Nova	**		35	50	06/73	20	0	20	X
Novell Data Systems	NEXUS 1	Nexus	PC		12	12	04/81	578	248	826	X
Olivetti	S-6000	Olivetti	S		19	35	01/82	70	-	70	NA
Onyx	4000	8086	S	k	15	20	10/80	100	250	350	200
	3000	8086, 8087	S	k	32	32	05/82	10	20	30	20
	5000	8088	S	k	12	13	05/81	250	450	700	200
	2000	8088	S		7	11	08/82	100	150	250	500
							TOTAL	460	870	1,330	
OSM Computer	Zeus 2	Z80	S		17	22	03/82	300	100	400	NA
	Zeus 3	Z80	S		8	12	07/82	200	150	350	NA
	Zeus 4	Z80	S		4	7	12/82	85	50	135	NA
							TOTAL	585	300	885	
Parallel Computer Co.	CPU-16/100, 200	68000	S		25	30	12/82	2	0	2	225
Pertec	3000	68000	S		19	60	10/82	105	195	300	NA
Plessey Peripheral Systems	SBC 200 Series	LSI 11/23	**		26	34	11/81	0	50	50	X
Prodigy Systems	Prodigy 1, 2	Z80-A	S		9	12	05/79	350	50	400	NA
Programmed Control	Prophet 21/1	TI 960/8	**		42	75	--/72	40	0	40	X
	Prophet 21/2	TI 990/10	**		57	100	01/78	95	2	97	X
	Prophet 21/3	Prophet	S		40	50	04/83	0	0	0	NA
	Prophet 21/4	Prophet	M		50	85	06/83	0	0	0	NA
	Prophet 21/5	Prophet	M		90	125	09/83	0	0	0	NA
							TOTAL	135	2	137	
Q1 Corporation	Q1/LMC	Z80, 8080	S		10	21	02/74	600	75	675	10
	Q1/Lite	Z80	S		6	24	02/77	700	450	1,150	50
	Q1 Microlite	Z80	S		10	13	02/79	250	330	580	20
	Q1 68000	68000	S		7	13	08/82	3	1	4	25
							TOTAL	1,553	856	2,409	
R2E OF America (U.S. Only)	XM	Z80	PC		0	20	03/82	20	-	20	NA
Randal Data Systems*	R-100 Series	Randal	PC		14	17	10/75	257	13	270	X
	R-200 Series	Randal	S		24	30	10/76	382	0	382	X
	R-300/400 Series	Nova 2/10	**		34	45	06/74	27	0	27	X
	R-500 Series	Randal	S		42	47	10/77	45	0	45	X
							TOTAL	711	13	724	
Retail Sciences, Inc.*	Clerk 700	PE 5/16	**		19	19	10/78	18	5	23	X
	Clerk 800	PE 5/16	**		25	25	04/79	25	15	40	X
							TOTAL	43	20	63	

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Name of Manufacturer	Computer Model	Processor Model	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Rexon Business Machines	RX15	8086	S		20	22	02/81	175	414	589	NA
	RX20	8086	S		23	28	04/80	149	75	224	NA
	RX30	8086	S		27	43	07/79	304	235	539	NA
	RX100	8086-2	S		11	15	10/82	25	31	56	NA
	RX400	8086-2	S		21	30	05/82	104	98	202	NA
							TOTAL	757	853	1,610	
Reynolds & Reynolds	VIM III	BTI 500	**		30	45	--/78	2,200	420	2,620	NA
	Expansion 6000	Z80	S		36	42	05/81	260	51	311	NA
							TOTAL	2,460	471	2,931	
Sentinel Computer	Sentinel Series	8086	S		21	39	07/79	125	75	200	NA
Space Byte Computer*	DBM/1	8086	PC		6	13	07/78	55	10	65	X
	DBM/2	Z80	PC		13	15	06/79	10	0	10	X
							TOTAL	65	10	75	
Span Management Systems*	TSS2	IBM Series 1	**		31	31	--/77	10	3	13	X
Sperry	BG 7	Univac	S		26	46	04/77	2,182	1,218	3,400	500
STC Systems	2000	Nova 3/12	**		34	80	09/72	108	2	110	X
	3000	Nova 3D	**		55	90	11/75	72	2	74	X
	4000	Nova 4	**		45	65	11/77	80	0	80	15
	5000	Nova 4X	**		54	125	10/82	125	0	125	25
	6000	Nova 4X	**		108	225	10/82	2	0	2	10
							TOTAL	387	4	391	
Symcro Systems	SB 700	SB 700	S		19	30	04/81	3	0	3	NA
Technico	TI32	TI9900	S		15	20	09/80	100	12	112	NA
Texas Instruments	BS600	16	**		30	40	08/82	200	125	325	300
Tri-Star Inc.*	TTK-10	Nova 3/12	**		45	55	02/76	12	0	12	X
	TEK-80	Nova	**		52	67	04/76	4	0	4	X
							TOTAL	16	0	16	
Ultimate Corp.	1000	LSI	**		28	35	11/82	25	0	25	X
	2000	LSI	**		34	40	11/81	225	50	275	NA
	750	LSI/11	**		20	20	04/83	0	0	0	NA
	C, D, E	Level 6 DPS/6	**		60	80	01/80	600	200	800	NA
							TOTAL	850	250	1,100	
Vanguard Computer	V400	Raytheon RDS500	**		45	52	06/77	2	0	2	X
	V500	Raytheon RDS500	**		65	85	03/76	6	3	9	X
							TOTAL	8	3	11	
Victory Computer Systems	Spirit	80186	S		14	18	06/83	0	0	0	NA
	Factor	68000	S		14	18	06/83	0	0	0	NA
							TOTAL	0	0	0	
Wang	2200	2200	S		10	19	04/73	12,040	9,460	21,500	X
	2200VP, MVP	2200VP, MVP	S		11	31	09/76	9,033	7,092	16,125	NA
	VS-25	2200VS	S		25	45	12/82	20	15	35	NA
	VS-45	2200VS	M		21	85	10/82	100	80	180	NA
	VS-80	2200VS	M		36	104	07/77	2,424	1,918	4,342	NA
	VS-90	2200VS	M		73	163	01/82	240	150	390	NA
	VS-100	2200VS	M		83	265	01/81	640	500	1,140	NA
	2200LVP, SVP	2200LVP, SVP	S		10	20	09/80	4,140	3,250	7,390	NA
							TOTAL	28,637	22,465	51,102	
Wintex Computer	200NS	Wintex	S		12	18	01/75	95	1	96	X
	MT 200	Wintex	S		10	20	10/79	210	0	210	X
	MT 86	Wintex	S		10	15	10/83	0	0	0	5
							TOTAL	305	1	306	
Zilog	8000	Z8001	S		15	30	07/81	490	210	700	X
							TOTAL	214,423	151,924	366,347	

Notes:
- a Includes installations of Eldorado 140.
- b Used Microdata processors until 11/76.
- c Includes retirements of Model B700.
- d Corporate name was changed from Warrex Computer Corporation when it was purchased by Electronic Data Systems, January 29, 1981.
- e Corporate name was changed from Automated Business Concepts in 1982, and from Broadcast Management Concept, March 1, 1980.
- f Marketed in the U.S. by Shasta General Systems.
- g Computer Hardware Division purchased from Pickland Associates during 1980.
- h Two Pi Corp was purchased by Four-Phase Systems, Inc. during 1980; Four-Phase was acquired by Motorola during 1982.
- i Qantel was acquired by Mohawk Data Sciences in 1980.
- j Mercator Business Systems was acquired by Onyx in November 1982 and its products incorporated into the Onyx line.
- k Corporate name changed from Educational Data Systems, March 1, 1980.
- * Not currently active in manufacturing or marketing Small Business Computers.
- ** To avoid double counting under the new classification, the system is tracked at the level of processor model only.
- NA Data is not available.
- X Model is not in new production.

+++ The code to IDC's new classifications:

M -- Medium Scale System;

S -- Small Scale System.

PC -- Personal Computer

NOTES TO MULTI-USER MICRO CENSUS

IDC is in the midst of redefining its system classes. Multi-user micros have been pulled out of the traditional desktop census to be placed in a small scale system category that will appear in next year's Review and Forecast. As far as installed base and forecasts go, multi-user micros are included in the "Desktop Computer" Red pages of the Review and Fore- cast Part 1 (July 8, 1983). They are not part of the "Personal Computer" numbers. We regret any confusion.

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MULTI-USER MICRO CENSUS

MULTI-USER MICRO CENSUS, AS OF JANUARY 1, 1983

Name of Manufacturer	Computer Model	Processor Model/Word Length	Old Size Class	New Size Class	Notes	Purchase Price ($1,000) Basic	Purchase Price ($1,000) Average	Date of First Installation	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Installed	Shipments Next 12 Months
Advanced Micro Digital	Superquad	Z80	D	2		1	1	01/82	7,000	2,500	9,500	10,000
Altos Computer Systems	ACS 8000-2	Z80	D	2		5	5	06/77	1,710	1,140	2,850	NA
	ACS 8000-5	Z80	D	2		6	7	10/79	900	600	1,500	X
	ACS 8000-6	Z80	D	2		10	10	11/79	720	480	1,200	X
	ACS 8000-7	Z80	D	2		11	11	--/78	1,080	720	1,800	X
	ACS 8000-10	Z80	D	2		9	9	05/81	2,880	1,920	4,800	NA
	ACS 8000-12	Z80	D	2		10	10	09/81	4,500	3,000	7,500	NA
	ACS 8000-14	Z80	D	2		12	12	09/81	3,360	2,250	5,610	NA
	ACS 8000-15	Z80	D	2		5	5	--/81	1,620	1,080	2,700	NA
	ACS 8600-12	8086	D	2		13	14	--/82	700	300	1,000	NA
	ACS 8600-14	8086	D	2		13	14	--/82				
	ACS 586-10	8086	D	2		8	8	01/83	0	0	0	NA
	ACS 580-10	Z80	D	2		6	6	02/83	0	0	0	NA
								TOTAL	17,470	11,490	28,960	
Artec Electronics*	Artec Systems	8085-A2	D	2		6	7	11/80	79	3	82	X
Barrington Computer Corp.	E'lite	Z80B	D	2		8	10	08/82	100	9	109	1,250
Billings Computer Co.	BC 6000	Z80	D	2		4	5	12/82	30	0	30	NA
Callan Data Systems	Unistar 200	68000	D	2		14	14	03/83	0	0	0	1,750
Canon (U.S. Only)	AS-100	8088	D	2		2	5	03/83	0	-	0	NA
Century Computer	Vanguard 8000	8086	D	2		3	9	10/82	55	12	67	1,000
Codata Systems Corp.	Codata 3300	68000	D	2		8	10	01/83	0	0	0	1,200
Columbia Data Products	964	Dual Z80-A	D	2		3	5	09/79	436	138	574	NA
	1600-1, 2, 3	8088	D	2		3	4	08/82	850	150	1,000	6,000
								TOTAL	1,286	288	1,574	
Compal	8200	Z80	D	2		13	14	01/80	1,600	35	1,635	1,000
Compupro	816	8085/8088	D	2		5	7	04/82	2,000	1,000	3,000	NA
Datamac Corp.	1600 Series	8086	D	2		3	5	08/82	45	5	50	2,500
	1600 Series	68000	D	2		9	14	04/83	0	0	0	500
								TOTAL	45	5	50	
Dataview Corp.	300 M	Z80	D	2		8	8	06/82	50	0	50	800
Digilog Business Systems	1800	Dual Z80-A	D	2		7	7	03/82	200	150	350	1,500
	1850	Dual Z80-A	D	2		2	2	09/82	80	20	100	200
								TOTAL	280	170	450	
Dual Systems Control Corp.	System 83	68000	D	2		17	22	01/82	147	3	150	400
Durango Systems	800 Series	8085	D	2		8	10	03/82	625	625	1,250	NA
	900 Series	8085	D	2		12	14	03/82	500	500	1,000	NA
								TOTAL	1,125	1,125	2,250	
Dynabyte	5200	Z80	D	2		4	5	--/78	1,840	860	2,700	X
	5300, 5305	Z80	D	2		5	7	--/79	1,050	700	1,750	X
	5400	Z80	D	2		7	9	--/79	450	250	700	X
	5800	Z80	D	2		18	23	--/80	125	75	200	X
	5900	Z80	D	2		19	25	--/80	175	100	275	X
	5505	Z80	D	2		7	10	--/81	900	800	1,700	X
	5605	Z80	D	2		7	11	--/81	1,410	940	2,350	150
	5710	Z80	D	2		9	13	--/81	1,240	760	2,000	300
	Monarch 6600	Z80, 8086	D	2		9	11	09/82	295	295	590	3,600
								TOTAL	7,485	4,780	12,265	
Eagle Computers	1600 Series	8086	D	2		7	7	12/82	40	10	50	NA
Elite Corp.	Consultant	16032	D	2		18	18	03/83	0	0	0	500
Empirical Research Group	ERG Series	68000/16032	D	2		8	14	04/81	100	240	340	250
Epic Computer Products	Episode	Z80-A	D	2		2	2	09/80	600	400	1,000	3,000
Fortune Systems Corp.	32:16	68000	D	2		5	7	04/82	2,400	350	2,750	NA
Fujitsu (U.S. Only)	Micro 16 S	Z80, 8086	D	2		4	4	12/82	5	-	5	13,000
Gimix, Inc.	Gimix	6809	D	2		3	7	--/80	1,400	600	2,000	NA
	Gimix	6800	D	2		1	1	--/78	700	300	1,000	NA
								TOTAL	2,100	900	3,000	
Hardy Computer Corp.	8001	8086	D	2		5	9	07/81	69	35	104	NA
	256	Z80-B	D	2		1	3	12/82	4	0	4	450
								TOTAL	73	35	108	
IMS International	5000	Z80, 8088	D	2	j	4	5	06/79	3,600	2,400	6,000	6,000
	8000	Z80, 8088	D	2		4	7	06/79	4,500	4,300	8,800	4,000
								TOTAL	8,100	6,700	14,800	

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Instrumentation Laboratory/Pixel Division	100/AP	68000	D	2		10	15	06/82	500	200	700	1,000
	80 Supermicro	68010	D	2		10	14	2Q/83	0	0	0	NA
								TOTAL	500	200	700	
Integrated Business Computers	IBC-40	Z80-A	D	2		9	13	--/80	200	300	500	X
	Cadet	Z80-B	D	2		10	15	07/81	800	600	1,400	2,000
	Mini Cadet	Z80-B, H	D	2		9	11	07/83	0	0	0	600
								TOTAL	1,000	900	1,900	
Keydata	Challenger	6502, 6800	D	2	k	1	5	--/78	12,145	1,655	13,800	X
	200 Series	6502, Z80	D	2		5	10	05/82	537	80	617	NA
	300 Series	Z80	D	2		9	15	03/83	0	0	0	NA
								TOTAL	12,682	1,735	14,417	
Micro V Corp.	Microstar I	8085A	D	2		8	15	08/78	2,250	2,250	4,500	1,000
	Microstar II	8086	D	2		12	25	09/80				
	Series 3000	8086	D	2		13	20	05/81				
	Series 1000	8088	D	2		3	8	09/82				
								TOTAL	2,250	2,250	4,500	
Micromation	M. System (Z80A)	Z-80A	D	2		7	7	10/82	50	20	70	1,000
	M. System (8088)	8088	D	2		7	7	01/83	0	0	0	500
								TOTAL	50	20	70	
Nabu Manufacturing Corp.	1600	8086, 8087	D	2		10	13	03/82	200	1,000	1,200	NA
NEC Information	200	NEC	D	2		5	7	06/82	850	-	850	NA
NNC Electronics	80	Z80	D	2		5	5	02/80	520	315	835	NA
	80W	Z80	D	2		9	9	11/80	540	315	855	NA
	53	Z80	D	2		10	14	11/82	10	0	10	NA
								TOTAL	1,070	630	1,700	
North Atlantic Industries	SBC-1 Shoebox	LSI-11/2	D	2		2	2	01/81	300	100	400	400
North Star Computers	Horizon	Z80-A	D	2		4	4	12/77	27,400	7,100	34,500	NA
Olivetti (U.S. Only)	P-6060	Olivetti	D	2		13	13	--/77	1,000	-	1,000	X
	P-6066	Olivetti	D	2		12	12	03/81	1,600	-	1,600	NA
								TOTAL	2,670	-	2,670	
Onyx	Sundance 2	Z-80A	D	2		9	10	05/82	91	39	130	125
	Sundance 16	Z-8000	D	2		14	15	1Q/83	0	0	0	
	C-5001/MU	Z-80A	D	2		8	9	09/81	290	125	415	200
	C-5000 1A	Z-80A	D	2		6	7	05/82	105	45	150	200
	C-5000 2A	Z-8000	D	2		12	13	02/83	0	0	0	200
	C-8001/MU	Z-80A	D	2		12	14	05/81	1,204	516	1,720	1,000
	C-8002	Z-8000	D	2		17	19	08/80	1,185	510	1,695	1,000
	C-8002A	Z-8000	D	2		14	17	02/83	0	0	0	1,000
Pertec	PCC 2000	8085A	D	2		8	13	09/78	1,670	2,870	4,540	NA
R2E OF America (U.S. Only)	Micral 9050	8086	D	2		5	5	09/82	0	-	0	NA
Rair Microcomputer	Black Box 3/20, 30, 50	8085	D	2		7	7	05/81	550	2,395	2,945	2,000
	3/60	8088	D	2		10	10	04/83	0	0	0	400
								TOTAL	550	2,395	2,945	
S.D. Systems	SD 100	Z80	D	2		7	7	04/78	200	65	265	X
	SD 200	Z80	D	2		10	10	05/77	455	150	605	X
	SD 700	Z80	D	2		20	21	09/80	85	30	115	X
	SD 610	Z80	D	2		14	15	02/81	130	55	185	X
	WS 800	Z80	D	2		2	4	02/82	5	0	5	X
	SD 300	Z80-A, B, H	D	2		2	2	2Q/83	0	0	0	1,500
								TOTAL	875	300	1,175	
Smoke Signal Broadcasting	Chieftan I	6800	D	2		2	3	03/79	2,500	1,000	3,500	NA
	Chieftan II	6809	D	2		2	3	03/80	2,250	750	3,000	NA
								TOTAL	4,750	1,750	6,500	
Systems Group	System 2900	Z80	D	2		6	8	08/81	0	0	0	NA
	Business Express	Z80	D	2		6	10	11/82	160	40	200	NA
	System 3200	68000	D	2		18	20	3Q/83	0	0	0	NA
								TOTAL	160	40	200	
Tab Products	1650	8088	D	2		9	10	1Q/83	0	0	0	NA
	1660	8088	D	2		12	15	2Q/83	0	0	0	NA
								TOTAL	0	0	0	
Tarbell Electronics	Empire I	Z80	D	2		5	5	01/81	100	0	100	50
	Empire II	Z80	D	2		5	5	03/81	100	0	100	50
								TOTAL	200	0	200	
Vector Graphics	5005	Z80-B	D	2		7	12	05/81	929	168	1,097	300
	5010	Z80-B	D	2		8	13	01/83	0	0	0	NA
	5032	Z80-B	D	2		12	16	02/82	253	54	307	NA
								TOTAL	1,182	222	1,404	
Wicat	System 150-3WS	68000	D	2		11	11	04/82	600	300	900	1,200
	System 150-6WS	68000	D	2		13	13	04/82	300	150	450	600
								TOTAL	900	450	1,350	
Zax Corp.*	The Box	Z80-A	D	2		5,995	5,995	01/82	0	800	800	2,500
	The Box	8086	D	2		6,995	7,995	03/83	0	0	0	3,000
								TOTAL	0	800	800	
								TOTAL	117,700	56,845	174,615	

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR SEPT. 9, 1983 ● V/19, NO. 8 P.J. MCGOVERN, PUBLISHER

ON-LINE SYSTEMS, NEW CHIP TECHNOLOGIES AND ARCHITECTURES SPUR MAINFRAME AND SUPERMINI STARTUPS

As an increasing percentage of user applications go on-line, the demand for powerful, expandable, and reliable large-scale systems will soar. Although growth rates in the supermini and mainframe markets are less than those at the low end, a combination of architectural and technological innovations are making the market for large systems equally tumultuous.

Wafer-scale chips, fault-tolerant CPUs, networking, multiple microprocessor systems and reduced instruction set architectures have spurred a wave of start-ups not seen in this segment of the market since the rise of the minicomputer. Although research consortiums have their role, the resiliency of the free market is again proving to be the nation's best bet to stay ahead of the Japanese.

As all this change takes place, the giants of the industry are faced with some difficult decisions. Unlike the rise of the micro, which created its own playground, these new systems challenge system builders on their own turf, especially as Unix gathers strength and third party software momentum. Among some of the key forces in the market for systems priced at $100,000 and up:

- Packaging. Trilogy is just the most visible symbol of the renewed interest in wafer-scale packaging, with faster speeds, on-chip redundancy and lower costs among the benefits. Improvements in design and manufacturing automation are making it possible, and the emergence of Cmos is adding momemtum, although Trilogy uses ECL.

- Entrepreneurs. Start-ups continue to have little trouble raising money. CDC may have started a trend by spinning out some of its supercomputer development work to ETA Systems. IBM's independent business groups point to the need to decentralize to serve new markets.

- Rising costs. VLSI design and manufacturing costs are soaring, and explains the interest of DEC, CII-Honeywell and Sperry in Trilogy. A market for semi-custom, system-level components is also emerging.

- Architecture. Largely because of software constraints, established system builders have been slow to bring out fault-tolerant CPUs and implement operating system concepts geared to new languages.

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Wafer packaging -- has the time come?

It's easy to understand the appeal of very large, wafer-scale, integrated circuits. The electrical paths are shortened (increasing speeds), bonding connections are reduced (reducing defects), and the manufacturing process condensed (lowering costs). On-chip redundancy adds further gravy (see page 3).

Thus, it is not surprising that the idea has been around for a long time, with a serious attempt made by the Air Force and Texas Instruments more than a decade ago. Until now, however, it has generally been believed that wafer-scale technology posed too many problems, with heat dissipation, brittle ceramics, high defects, design complexity, and R&D costs key among them.

But packaging technology remains a vital area, and the distance between electrical connections is one of the major barriers to improved large system performance. IBM spent vast sums of money on its thermal conduction modules (TCMs), which allow some 100 chips to be mounted on a 3.5" ceramic square. The giant's approach remains the densest packaging available today, allowing IBM to match PCM performance while still using rather mundane TTL circuitry.

In numerous interviews, Trilogy spokesmen have said that one ECL Trilogy 2.5" x 2.5" chip will contain about two-thirds of the circuitry in an IBM TCM and because of its compactness it will be twice as fast and much cheaper to build. The company claims a CPU equivalent to one of IBM 308Xs can be built with as few as forty chips.

Although there are doubts about Trilogy's ability to deliver (delays have pushed shipments back to 1985), the interest of Sperry, DEC, and CII-Honeywell shows that many are impressed. Rumors persist that other large companies are also considering buying a stake. Thus far, there hasn't been a hint of Japanese input, so perhaps the Amdahl history won't be repeated. To feed the capital hungry project, Trilogy has decided to go public with an offering expected to raise from $72 to $90 million, bringing its total to around $200 million.

Since DEC and the members of the Bunch are hard pressed to come up with the R&D needed to keep up with IBM's large systems, it's understandable that they would look toward a Trilogy for a cost-effective solution. Indeed, it now appears that Trilogy's "system foundry" and technology licensing businesses may become as important as its efforts to build a superfast IBM compatible machine. DEC surprised everyone by axing its mainframe project a few months ago, and may be interested in new approaches to building the large systems it will need.

Carlton Amdahl has said that Trilogy's chip designs can be implemented in Cmos and Gallium-Arsenide, and it has already made plans for joint manufacturing with DEC. In a recent speech, DEC president Ken Olsen said that DEC is very interested in Trilogy's design tools. Trilogy has had to break new ground in the CAD field in order to cope with the complexities of its big chips.

Cooling remains a key issue. The elaborate, piston-based system in IBM's TCMs is perhaps the best indication of the challenge. In that system both helium and water cooling are used at both the chip and module level. Honeywell uses a somewhat similar approach which is also believed to be very expensive. Trilogy has kept its heat dissipation concepts a secret. In a recent interview, Gene Amdahl noted that the emergence of low-power consuming Cmos was one of the most exciting of recent technological developments.

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As evidence that the visionary Amdahls are not the only believers in the wafer-scale technology, a group of former Synertek (owned by Honeywell) executives have left that firm to start up Wafer Scale Integration (Los Altos), with the charter to build semi-custom, system level circuitry. WSI's approach is different from Trilogy's since it will concentrate on semi-custom systems, using Cmos and less-than-mainframe complexity. It considers its approach to be an evolution from existing standard cell and gate array techniques.

A third group is bubbling up in Michigan. Former Burroughs Chairman Ray Macdonald; graphic terminal maker, Evans and Sutherland; Energy Conservation Systems (headed by Stanford Ovshinsky); and a lot of venture capital have coalesced into Mosaic Systems (Troy, Mich) which appears to be looking at programmable wafer-size circuits, although the company has yet to fully describe its plans. The group is loaded with ex-Burroughs engineers.

Redundancy ... a hidden bonus

Given both the size of the die and the complexity of wafer-scale defects, Trilogy and WSI are both intending to put redundant circuitry on each chip, a practice that has become popular with high-density (64K and up) memory makers trying to increase yields.

Although redundancy seems necessary for wafer-scale circuits, Trilogy intends to turn the requirement into an opportunity. It believes that it can bypass the traditional two-processor approach to fault tolerance by putting so much redundancy on each chip that the systems will virtually never breakdown. Skeptics point out that it is much easier to put back-up capability onto a standard memory chip than it is for the more complex logic circuits.

Presuming that Trilogy can deliver, its approach to redundancy could have very significant ramifications for what is still a nascent market. EDP/IR has counted at least ten vendors of fault tolerant hardware, but as yet the major vendors haven't made their move. IBM and HP have dabbled a bit (see EDP/IR, V/18, # 14) and DEC, NCR and others have made noises, but not much has happened.

There are probably two main reasons why the giants of the industry have thus far not moved very aggressively. First, there is still some doubt about customer willingness to pay for redundancy. After all, such relatively cheap system safeguards as uninteruptable power supplies are often not used.

Secondly, and probably more importantly, software restrictions may make it difficult for the established vendors to come out with fault tolerant systems that don't resemble a kluge, as operating system modifications will be substantial in many cases. To the extent that this is a factor, it makes a lot of sense for system vendors to at least take a look at on-chip, single processor fault-tolerant solutions. The Japanese also seem to believe that high reliability can be achieved without building redundant CPUs.

As it did with its ETA Systems supercomputer spinout, CDC may also spin out a group to attack the fault tolernat market. A former CDC vice president has just left that company to start Corinthian Systems, which will target the 32-bit fault-tolerant transaction processing market, with an emphasis on banking, insurance, and hospital systems. Although CDC is not yet formally involved, it says that it is considering taking an equity position. Such spinouts may well become a popular means for major firms to get into new markets quickly.

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THE EXPANDING WORLD OF UNIX

"The goal of the Bell system is to work with the user community to make the Unix system the common basis for applications from micros to mainframes." -- Larry Crume, head of Unix System Planning, Bell Labs.

This goal is rapidly coming within grasp. Unix, or one of its variants, now runs on everything from the IBM PC to the Univac 1100 series. It has become the favorite of 16 and 32-bit micro and mini start-ups and is well entrenched in the scientific community. Best estimates are that some 70 hardware vendors have now adopted some form of Unix. A nod from IBM would be the final blessing, and rumors persist that IBM is about to at least tacitly endorse Unix on both its PCs and its 4300-type systems.

IBM is understandably a little wary of Unix. If Unix becomes the standard on both mini and micros, it is only a matter of time before significant demand emerges for Unix on mainframes. This will be especially true in large organizations that want to easily swap data between systems. Unix is equally at home in all three environments (although some say it is too slow on micros) and thus it represents the only serious threat to the 20 year hegemony of the 370 architecture. Amdahl has supported Unix since 1977, and user interest is rising.

But since IBM does not exist in a vaccuum, it will find it difficult to resist the request of its customers if significant numbers begin to clamour for Unix. DEC is no doubt feeling a similar queaziness as its VMS operating system faces its first serious challenge. Hewlett-Packard believes that Unix is a virtual shoe-in in the scientific market, and a strong candidate in the commercial sector. Smaller vendors in search of software see Unix and its promise of applications portability as a potential godsend.

Unix has had a rocky history. High commercial license fees and lack of support limited it to universities for years, and AT&T never completed a polished commercial version, encouraging the many variants that threaten portability. There are Unix derivatives (building off licensed AT&T code) and Unix look-alikes (imitating Unix-like concepts). Additionally, Unix's programmer orientation convinced many that it was not suited for consumer environments.

Over the last year or two this has changed. Western Electric is building a Unix marketing group, and has begun to work closely with standards groups as well as leading microprocessor vendors. It has also been putting a lot more emphasis on building full-blown commercial systems. Cobol compilers have even begun to appear, although not from AT&T yet. Efforts to improve ease of use have been increased with the idea to build a simple user interface on top of the established Unix kernel.

The healthy rate of supermini start-up companies has also been a positive force in generating Unix interest. Unix availability has enabled many firms to get to the market quickly and relatively cheaply. At the micro level, Unix's potential in multi-tasking operations has made it attractive, and this should pick up when AT&T announces its line of personal computers.

Perhaps a more subtle long-term problem is that the Bell system relies heavily on Unix, and thus the long term direction of the Unix kernel will be shaped by the needs of two masters -- the nation's telephone and data networks and its growing base of commercial and scientific customers.

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Unix blends with Risc

Over the last few years, most of the improvements in machine performance have come from faster and denser circuits. Architectural advances have largely been the realm of the universities and a few start-ups. Research done since 1980 at UCal Berkeley, Stanford, and Carnegie-Mellon has suggested that Reduced Instruction Set Computers (Risc) are in fact more efficient than the Complex Instruction Set Computers (Cisc) that have dominated the industry so far.

Pyramid Systems (Mountain View, CA) looks like it will be the first vendor to build a commercial system that implements the Risc concept, marrying it with a Berkeley-enhanced version of Unix V. It will also be the first to build a proprietary CPU designed with Unix in mind, implementing its 32-bit 90x processor in TTL circuitry with 125 nanosecond cycle time. Ridge Computers (Sunnyvale, CA) is also using a Risc architecture in its 32-bit engineering systems.

The guiding principle of Risc computers is that simpler is better. The emphasis is on short, simple instructions that can be performed in one or two machine cycles. An intensive use of registers is aimed at cutting accesses to memory. Complex functions are farmed out to software where the overhead is incurred once rather than during many instructions. (See EDP/IR, V/18, #3). Pyramid claims that by minimizing memory references, most high level language constructs can be executed twice as fast as on most 32-bit superminis.

Pyramid sees its machine as primarily appealing to scientific, engineering applications, or other computational-intensive tasks that require large real (up to 8MB) and virtual memory. Systems support from 16 to 128 users with prices ranging from $100,000 to around $300,000. Key executives come from IBM, Rolm, HP and Plexus. First and second round financing now totals $21 million.

Elxsi starts shipping 64-bit system

Among the recent start-ups, Elxsi (San Jose, CA) wins the award for exotica. Although it has just begun shipping its 64-bit System 6400, the company already has manufacturing facilities in Singapore, and is working with the Indian conglomerate Tata, forming a Tata-Elxsi joint venture. The system is expected to be marketed in the U.S. and throughout the Pacific Basin and the Middle East.

The Elxsi system is a general purpose workhorse. A single processor (on just three cards) operates at 4 MIPs and multiprocessor versions offer performance up to 40 Mips. Its proprietary ECL CPU has a cycle time of just 50 nanoseconds; its system bus pumps up to 320MB/sec, and the system can support main memory of up to 192MB. Elxsi claims to pack more power per cubic inch than anyone, with 20 MIPs and 64MB in a 32"x59"x69" cabinet. Unlike most start-ups, Elxsi has built its own message-based operating system, called Embos, which is said to be similar to but not compatible with Unix. Unix support is expected.

Elxsi sees the machine competing in a variety of scientific and transaction processing environments, and claims a dramatic price/performance advantage over the competition. It believes that its multiprocessing versions can take on Cray and IBM, while its uniprocessor systems outdo the fastest of the superminis. Elxsi prices range from $600,000 to $4,000,000. Digicon Geophysical (Houston) is an early customer; it will sell the 6400 as an upgrade to the turnkey Vax 11/780 systems it sells to the seismic data market. Elxsi was founded in 1979 by DEC, HP, and Amdahl alumni.

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COMMERCIAL SATELLITE CAPACITY TO DOUBLE BY 1987
BUT STRENGTH OF DEMAND REMAINS QUESTIONABLE

The deregulation and divestiture of AT&T is only the most visible sign of the increasingly open competition in telecommunications services. Packet switching, long-distance phone services, cellular radio, and satellite carrier services have all witnessed significant injections of new capital and entrepreneurial ambitions. No matter what one's feeling on the break up of the phone system, deregulation is quickening the pace of the market development.

Satellites continue to be a hot area. The FCC has recently reduced the distances between orbiting satellites to make room for the 29 birds it has approved for launch between now and 1987. Taking retirements into account, some 38 commercial satellites will then be in operation, up from 19 today. The recent FCC approvals brought five new firms into the market, bringing the total up to eleven.

These eleven firms consist of established players such as Western Union, RCA Americom, Satellite Business Systems and Comsat. Other carriers who are launching their first satellite but aren't new to the business include Hughes Communications, American Satellite, GTE/Southern Pacific Communications and AT&T. United States Satellite Systems (NYC), Rainbow Satellite (Brentwood, CA), and Advanced Business Communications (Maclean, VA) are three newcomers.

When all the new birds are in place (assuming all the planned satellites are launched) capacity will at least double, probably more so since advances in earth station technology will allow for more efficient broadcasts. But among the four primary sources of demand -- voice, video, data, and facsimile -- it is not clear which will require the new capacity. Among some of the key issues in the satellite industry:

- Technology. Right now only SBS broadcast in the high frequency ku-band (12 to 18 gigahertz); the other vendors use the C-band (4 to 8 Ghz). Over the next five years, over half of the new satellites will be ku-band which, because it is not bothered by microwave transmission, can better serve metropolitan areas.

- The voice market. As SBS, ITT, Western Union and others join AT&T, MCI, and GTE/SPCC in the voice market, the demand for voice transponders is increasing. MCI has contracted for 24 of Hughes' transponders, the equivalent of 48,000 voice circuits.

- Video. Video remains a core market that is growing, but unless services such as direct broadcast satellites catch on, major growth will be difficult to sustain, especially as cable TV faces significant competition from microwave systems.

- Business. New comers U.S. Satellite Systems, Advanced Business Communications, and Rainbow all say they are going after the business market. But if SBS can't generate business usage, who can?

- Computer vendor relations. In addition to IBM/SBS, American Satellite is working with Tandem and Mitel. Wang has bought a minority interest in U.S. Satellite and is expected to lease some transponders. U.S. Satellite is expected to stress small earth stations.

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CURRENT AND PLANNED COMMERCIAL SATELLITES, U.S. FIRMS
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Vendors	Number in Operation	C-band	Ku-band	Planned	C-band	Ku-band
Western Union	4	4	0	6	3	3
RCA Americom	6	6	0	4	1	3
SBS	3	0	3	2	0	2
AT&T	1	1	0	2	2	0
Comsat	4	4	0	0	0	0
Amer. Sat.	0	0	0	2	1*	1*
GTE/SPCC	0	0	0	5	3*	2*
Hughes Comm.	1	1	0	2	2	0
U.S. Sat. Sys.	0	0	0	2	0	2
Rainbow Sat.	0	0	0	2	0	2
Adv. Bus. Com.	0	0	0	2	0	2
Total	19	16	3	29	12	17

* American Satellite and GTE/SPCC will launch hybrid ku/c-band satellites.

SBS update

Satellite Business Systems, the joint venture of IBM, Comsat, and Aetna Life and Casualty continues to chew up enormous amounts of cash. A recently expanded credit line has brought total SBS funding up to some $1.3 billion. As the data below shows, revenues remain relatively small.

	First Six Months 1983 ($M)	First Six Months 1982 ($M)
Revenues	$ 53.2	$10.9
Operating costs and expenses	124.3	66.4
Net Loss	70.1	55.5

Despite this gloomy picture and the enormous capital costs associated with building the network, SBS says that it expects to cross over into profitability in 1984. But if it does, it will do it through a traffic mix far different than the massive data transmission networks once envisioned.

Increasingly, SBS revenues are coming from traditional video and voice markets. As of September, twelve of SBS's 30 transponders are carrying video programming; six are for customer networks, and three are for long-distance voice. The rest are used primarily for back-up.

In a move that could provide new stimulus to the business market, SBS has petitioned the FCC to lift the ban on joint IBM/SBS marketing. SBS reasons that the number and size of its satellite competitors has obviated the reasons for the original arms-length requirement.

As it stands now, SBS can't call in IBM representatives when doing business with a shop that uses IBM equipment. Such cooperation is often necessary when cutting over to a different type of network, and SBS is free to interact with any other hardware vendor. The danger of the IBM/SBS tie is that IBM's data processing revenues could theoretically cross-subsidize its communications services to lock up major customers. The FCC decision is expected soon and will be good measure of just how laissez-faire this administration really is.

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• DEC, DG TELL OF MICROPROCESSOR SUPERMINIS. Taking the offensive at a time when the company has been criticized for its slow pace of product introductions and faltering financial performance, DEC president Ken Olsen announced that three DEC-developed microprocessor VAX systems will be introduced within the near future. The micro-VAX CPUs are expected to have roughly the power of the 11/730. Olsen also hinted that the new high-end Vax will also be announced before next June, with deliveries late in 1984.

At the upcoming IEEE Computer Design Conference, Data General is expected to provide details of its 32-bit MV/8000 5-chip set -- CPU, sequencer, floating point unit, I/O unit, and burst multiplexor channel unit. The chip set is said to have 50% of the power of the /8000. Hewlett-Packard and NCR are already marketing products based around propietary 32-bit microprocessors.

• STC SHOWS NEW TAPE DRIVE. Tired of waiting for IBM to announce its eternally rumoured 3420 replacement, Storage Technolgoy has announced its 4670, a start-stop tape subsystem capable of handling data transfers of up to 3MB/sec, with capabilities of 6MB/sec when IBM unveils that capability.

Among the key attributes of the 4670: it can be placed up to 400 feet from the CPU (compared to 120); it takes up 25% to 47% less floor space; uses 50% less power; it can operate 3, 2, and 1.5 MB per second by using a 32KB buffer call the Accelerator (the previous maximum was 1.25MB/sec); improved diagnostics; and more efficient channel utilization. The 4670 works with all 370, 303X, 4300, 308X and compatible CPUs. List prices range from $46,800 to $68,440. A 200 ips model 4674 sells for $20,850. The 4670 has been installed at customer sites since mid-July; volume shipments are scheduled for the fourth quarter of 1983. IBM's recently cut the price of its 3420 by 20%. Its code-named Del Oro streaming tape drive has been expected for some four years.

• HARRIS, LANIER OUTLINE MERGER TERMS. An agreement in principle has been reached that would have Lanier operate as a subsidiary of Harris, keeping the Lanier Business Products name. The move is seen as a blend of Harris technology and money with Laniers' sales and distribution strengths. Lanier had 1982 revenues of $380 million, Harris $1.4 billion. The value of the planned merger transaction is estimated to be some $415 million.

• WANG BUYS 4% OF TYMSHARE. Trying to keep its wide area networking options open, Wang has sunk some $10 million in both Tymshare and U.S. Satellite Systems. The interest in Tymshare almost certainly centers on that company's Tymnet packet-switched network. Tymshare has had some rough times lately, reporting a net loss of $915,000 for the first six months of 1982 with revenues down 7%; it has been a rumored acquisition target for a long time. Wang notes that it has no interest in taking a controlling interest in Tymshare at this time. Sales of the company's Wangnet remain sluggish.

• TI BUYS INTO LISP COMPANY. Texas Instruments has acquired a 25% share of LISP Machine Inc. (LMI), Culver City, CA. LMI produces artificial intelligence machines and provides advanced application software development. LMI's upcoming Lambda Machine is based around TI's NuMachine.

• HP SHIPS 25,000th 3.5" MICROFLOPPY.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR AUGUST 7, 1983 ● V/19, NO. 7 P.J. MCGOVERN, PUBLISHER

IBM STRATEGY CONTINUES TO EVOLVE, JUGGLES OPEN ARCHITECTURE AND PROPRIETARY INTERESTS

It certainly has been a nice summer for IBM. After basking in flattering cover stories by Fortune and Time, the giant has again announced revenue and earnings increases (18.2% and 24.3%, respectively) that are the envy of the industry.

With the U.S. economy struggling to meet foreign competition, public acclaim over a real, live American success story is hardly surprising. But what has gone unsaid is that as information technology rises to pre-eminence, this new, aggressive IBM is rapidly establishing itself as the single most important enterprise on the planet. If the giant fails to deliver its customer base into the automated world of tomorrow, the computerization of society will take that much longer. As IBM goes, so goes the industry. Some of IBM's key concerns:

- Open architecture. The success of the open architecture Personal Computer and the publication of its Document Content and Interchange specifications suggests a major strategic shift away from the proprietary attitudes that characterize the giant's mainframe business.

- Growth. By 1990-92, IBM should reach the $100 billion revenue mark, well on its way toward becoming the world's largest corporation. To do this, two new companies the size of today's IBM have to be built over the next eight to ten years. New markets are a must.

- Networks. SNA will require major changes to deal with the proliferation of workstations and multi-host systems. IBM's DCA/DIA specifications could prove to be as important as the 370 architecture, and DCA/DIA, like SNA and 3270, may well become a de facto standard.

- Competition. IBM's traditional competitors have been neutralized. The giant's main worries now are AT&T in networking, the Japanese in semiconductors and systems, and DEC and Wang in mid-range systems.

- Voice communications. Satellite Business Systems and the Rolm connection position IBM for a major entrance into the voice market.

- Joint ventures and OEM deals. Burying the "not invented here" syndrome, IBM is doing whatever's necessary to address new markets.

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Networking issues, DCA/DIA

As IBM looks out over the next decade, the most compelling single force to be dealt with will be the sheer proliferation of devices. It is not at all inconceivable that by 1990, the number of information workstations will equal, perhaps even exceed, the number of white collar workers. As the number of workstations increases, so does communications between them. Today's data networks must be reshaped to meet these needs.

Although IBM's SNA is, by industry standards, a sophisticated network management system, it will have to undergo significant future changes. SNA was designed for single host, dumb terminal, slow speed tasks, with all data traffic passing through the host. Adding, moving, or deleting devices remains difficult. These attributes do not mix well with an industry moving toward peer-to-peer links between intelligent, end user-controlled devices.

Thus, although there are far more SNA networks than any other kind and vendors are finding SNA support to be a necessity, SNA alternatives are emerging. Packet networks such as those by GTE/Telenet and Tymshare's Tymnet are gaining momentum, and processing services firms, such as Geisco, and AT&T's American Bell are also entering the value added network market. Dixon Doll of the DMW Group has dubbed these intelligent networks as "fourth generation networks."

It is in the area of network management that the new AT&T looms as such a threat. Never mind its initial stumblings. If computers are to communicate as easily as telephones, AT&T is likely to be a big part of the solution. AT&T has already promised that its Net 1000 will "do for data communications what the switchboard did for voice communications." When one considers the smooth operation of the millions of devices in the phone system -- complete with ease of installation, usage billing, diagnostics, and alternate routing -- one realizes how far today's cumbersome, dedicated application networks have to go.

IBM's Satellite Business Systems, its Information Network, and its cooperation with Rolm are just the first three steps toward turning IBM into an aggressive communications company. IBM has no choice but to pursue this market. Integrated digital networks will be the heart of both intra and interenterprise systems, and the capabilities of the network will dwarf those of the devices attached. The network and the system are becoming one and the same.

Despite SNA's shortcomings, the industry can thank IBM for whatever communications standards it has. SNA and 3270 are already well entrenched and EDP/IR expects IBM's Document Content and Document Interchange Architectures to provide the next de facto standard. The only real rival to IBM is the X.25 standard, which although important in Europe, has yet to catch on big in the U.S.

It was, most likely, the proliferation of incompatible mid-range systems -- Series/1, 8100, S/34, S/38, 4300, 5520 -- and the emergence of text processing that convinced IBM that it needed an overall communications standard so that documents could be exchanged and worked on using diverse hardware. DCA/DIA looks like the answer, and since IBM has published its DCA/DIA specifications, it is likely that those vendors who are pushing SNA support today will eventually also offer DCA/DIA. John King, an SNA consultant with DMW, says that IBM has become much more supportive of other companies both with SNA and DCA/DIA, and that this represents a major shift in IBM philosophy. The success of the open architecture with the IBM PC has apparently not gone unnoticed.

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Once DCA/DIA is implemented, IBM will have much more incentive to start pushing local area networks. Physical LAN links are relatively insignificant, the key is in the software that makes document and file transfers effective.

It now appears that IBM will continue to support multiple mid-range products as a means of meeting diverse market needs. The effect of merging the old OPD, GSD, and DPD divisions has not been to consolidate product lines, but rather to move the center of debate within IBM instead of in front of the customer. Over the last year, IBM has made significant enhancements to all its mid-range lines, enough to convince EDP/IR that none are about to disappear.

Although IBM's chief scientist Louis Branscomb has said that the "future is centered on powerful workstations," EDP/IR believes that there will often be a need for nodal processors between the workstation and the mainframe. Some type of local controller will be needed to handle distributed and departmental data bases, as well as to provide access to local shared resources such as disk and printers. Among some of the mid-range developments expected by EDP/IR:

- A smaller version of the S/36 that supports three to eight users to better compete in the small business market with the type of systems sold by Altos. IBM describes the S/36 as the "first of a family."

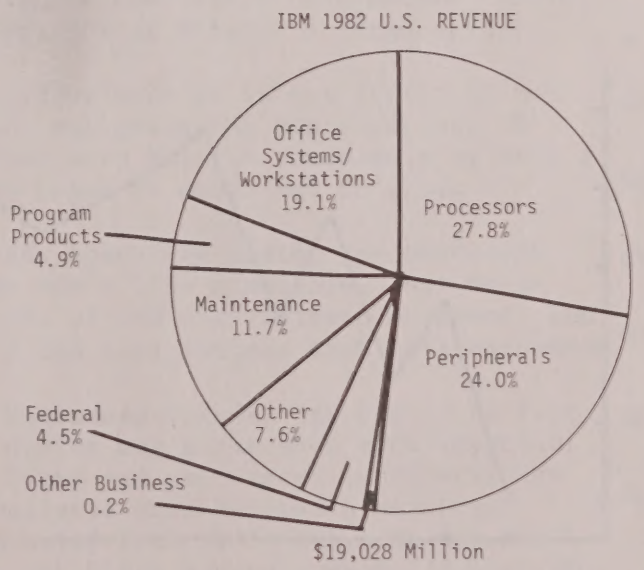
- Smaller 370-compatible machines, probably even a single user version. These machines will be designed primarily for distributed processing and terminal tasks. Additionally, a larger air-cooled 4300 replacement is expected soon.

- Faster S/38s, large users such as General Motors continue to find the S/38 appealing as a department level systems, but need more power.

- Larger 8100s, the new VLSI chips in the 8130B indicate that IBM is still investing in the 8100 which has always been underpowered.

- Further enhancements to the Series/1 with an emphasis on packaging and configuration flexibility.

The information opposite comes from IBM's 1982 10K report. "Office Systems/Workstations" includes the Personal Computer, the Displaywriter, the Datamaster, the 5280, 5100, typewriters, and retail and banking equipment. "Other" includes IBM's independent business units -- The IBM Information Network; Information Systems Services (consulting); Telecommunications Carrier Products; Biomedical Systems; IBM Instrumnents; and Industrial Automation. "Federal Systems" consists of specialized products for space and defense agencies. "Other Business" consists of materials and services for testing and training.



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Not only will IBM's multiple product offerings continue, but as IBM's PCs expand their capabilities the overlap may even increase. It has been rumored for months that, in addition to its low-end Peanut product, IBM has a multi-user micro in the works, probably based on Xenix or some other Unix variant. As IBM rides the Intel microprocessor family from the 8088 to 188, 186, 286, and 386, multi-user versions will become increasingly feasible.

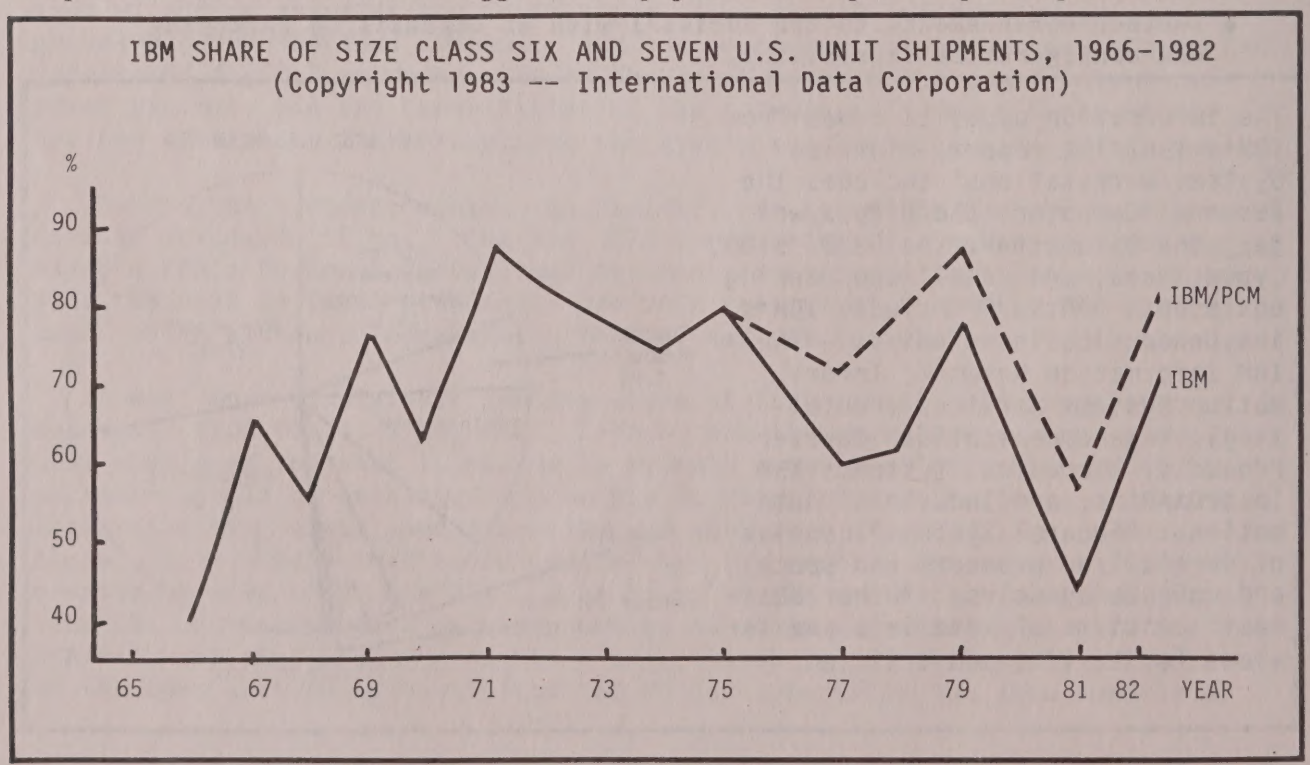
Thus the issue as to whether IBM will continue to have an open architecture PC is really a "yes and no" situation. Yes, today's PC will probably go down an open architecture path, but single-user versions of the 370-architecture will also lead to a proprietary product line. There's room for both.

If IBM wants to cover all its bases, it could follow the path of Honeywell and Data General. Both of these firms have gone with dual microprocessor micros, an Intel chip for personal computing tasks, and a proprietary chip that runs each company's respective operating system. In the IBM case, this would mean putting, for example, an Intel 188 in with a second chip that runs the 370 software. As is often the case, whatever IBM does will probably set the tone for the rest of the industry.

Mainframe outlook

IBM's high-end position has seldom looked stronger. IBM's share of size class six and seven U.S. unit shipments reached 72% and the IBM/PCM share reached 81%. Although part of the reason was that IBM caught its mainframe competitors between product cycles, the results look similar for 1983, and IBM may well be establishing a level of high-end dominance not seen since 1971-73.

It is easy to see the high-end efforts of Burroughs, Univac, CDC, and Honeywell as effectively crippled. Facing a nasty combination of rising development costs, shorter product life cycles, and dwindling profits (see charts), these firms will find it difficult to justify the investment needed to keep pace, as Japanese PCMs force IBM to aggressively push for improved price/performance.



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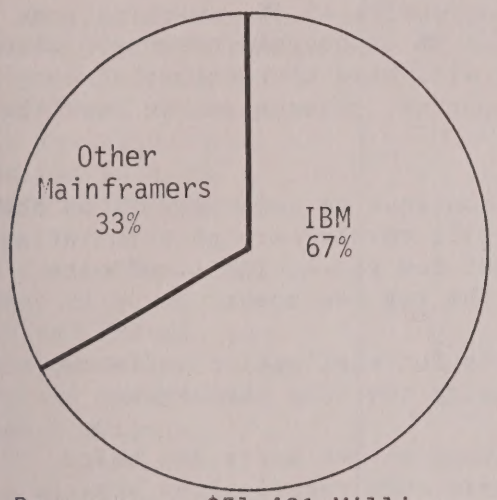
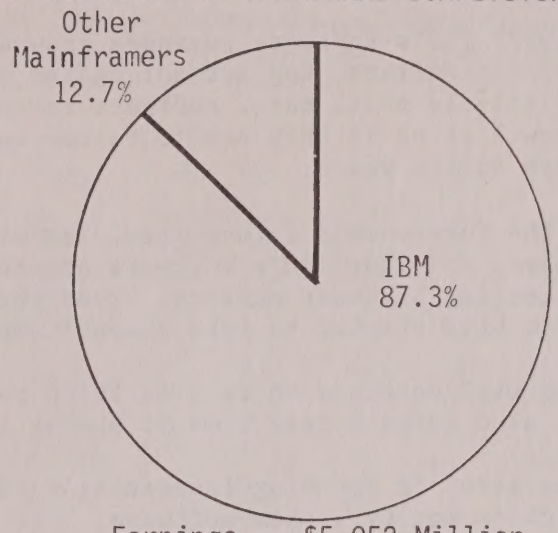
IBM'S SHARE OF 1982 REVENUES AND EARNINGS vs. MAINFRAME COMPETITORS*



Revenues -- $51,421 Million



Earnings -- $5,052 Million

*DEC not included.

To remain competitive, IBM's traditional rivals are trying to preserve their bases while checking out joint ventures, considering IBM compatibility, and looking for specialized mainframe niches. To IBM it doesn't matter if these firms live or die. What matters is that their growth paths in the commercial market have been diminished and IBM equipment continues to be the traget of most third party software efforts. IBM's mainframe attention will increasingly be centered on controlling the PCMs. Some key IBM concerns and weapons:

- Technology. IBM cannot afford to become dependent on Japanese chip technology, and is worried about the RAM memory situation. Pumping cash into Intel may be only the start of the defense. Trilogy, with its wafer-scale integration, is also a potential technological threat.

- The Pacific basin market. The Japanese think that they can dominate the entire Asian market. Low-profit sales in the U.S. and Europe allow them to keep up manufacturing volumes until this market ripens. National Advanced Systems now takes 50% of Hitachi's large systems.

- Pricing. IBM has shown with the 4300s that it is not afraid to cut prices to squeeze the competition, but given the PCM's current 5% market share, IBM would hurt itself more than it could gain by such a move. Pricing remains an ace IBM hopes it never has to play.

- The moving target. By changing its operating system and microcode implementations, IBM can make the PCM's life miserable. But major system software changes tie up lots of IBM and customer manpower, and IBM wants its users free to build the applications that sell hardware.

- Lawsuits. The fallout from the Japanscam scandal has yet to be felt, but the giant's suit versus NCR Comten may prove even more important. IBM complains that NCR Comten's front end processors improperly use IBM source code. It is widely believed that Fujitsu's mainframe operating systems has borrowed heavily from IBM's MVS. In the NCR case, IBM may well be seeking to establish a very powerful precedent.

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Software expectations

In 1982, IBM's software revenues grew an impressive 45.3%, reaching some $1.7 billion dollars, and accounting for some 4.9% of overall revenue. Given this relatively small base, software revenues will have to continue at very high growth rates if they are to become an important revenue source over the next five to ten years.

For the foreseeable future then, IBM will continue to rely heavily on hardware sales, and thus IBM's software strategy will revolve around stimulating and protecting hardware markets. Over the last few years, IBM's software attitudes have started to take shape. Among the key features:

- IBM will continue to rely on third parties for application software. It also doesn't have time to pursue industry specific strategies.

- The giant is becoming increasingly reluctant to let users and third parties modify system software. Its source code restrictions are the first step in efforts to maintain operating system integrity.

- After long neglect, IBM hopes to reassert control over data base management operations. If it proves popular, the company's new Database 2 relational DBMS will spur new high end sales. (See V/19, #4.)

- Large users will need IBM's MVS/Extended Architecture.

Joint ventures and OEM deals

Even with a 1982 R&D budget of $3 billion, it is impossible for IBM to develop all its products in-house, and thus it has become an active player in the international partner-picking that has swept through the industry for the last few years. By not developing everything in-house, IBM will also find it easier to meet the needs of fast changing markets such as personal computers. So far at least, IBM has shown excellent judgement in these matters.

Rather than join consortiums or large joint projects, IBM prefers to make private deals with individual corporations while establishing close ties to universities. It has decided not to join both the Microelectronics and Computer Technology Enterprise and the Japanese Fifth Generation project, but has joined the university-based Semiconductor Research Association.

As for private deals, the big four are those with Intel, Rolm, and Matsushita, along with the financing deal with Merrill Lynch. But IBM also has significant OEM ties with Cipher (4968 tape drive), Epson (PC printer), Toshiba (Scanmaster subassemblies), and Hitachi (3200 laser printer). It also has many other deals for less strategic products, and has been much more cooperative with third party leasing groups.

The outside help fits in with IBM's new willingness to get into markets relatively early and grow with them, and there is virtually no doubt that cooperative deals will continue. As long as IBM has the green light from the government, it may as well use its huge cash reserves (1982 profits of $4 billion) to invest in companies it thinks can help it. The main question is who's next? A small systems peripheral maker? a communications equipment vendor? a voice carrier? a distribution channel? a service bureau? a software house? a bank?

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The census information opposite offers IDC's latest estimates of the installed base for all past and current IBM systems.

As can be seen in the "Date of First Installation" column, product cycles for large systems have indeed been shortening.

For example, 56 months elapsed between shipments of the 370/168 and those for the 3033. While only 43 months separated the 3033 from the 3081. Similar contractions can be found among 4300 class machines and their 360/370 predecessors, and EDP/IR expects this trend to continue for the next generation of products.

IDC's overall mainframe, mini, and small business census data will be coming in a September issue.

****

The preceding information and analysis has been excerpted from IBM, The Giant Awakens, a new special report prepared by the editors of EDP/IR. The 65-page, single-spaced report can be ordered now for $295. Call Mary Trayte at 1-800-343-4952.

IBM CENSUS, AS OF JANUARY 1, 1983
(Copyright 1983 -- International Data Corporation)

Name of Mfg.	Computer Model	Average Purch. Price ($000)	Date of First Install.	Number Installed in U.S.	Number Installed Outside U.S.	Total Number Install.
IBM	3031	2,440	03/78	840	1,016	1,856
	3032	4,130	03/78	205	440	645
	3033S	3,380	01/81	145	85	230
	3033N	3,856	01/80	300	380	680
	3033UAM	7,290	03/78	970	635	1,605
	Subtotal			2,460	2,556	5,016
	3083E	3,200	2Q/83	0	0	0
	3083B	4,800	1Q/83	0	0	0
	3083J	6,000	1Q/83	0	0	0
	3081D	7,300	10/81	600	620	1,220
	3081G	6,900	09/82	90	70	160
	3081K	7,900	05/82	270	250	520
	3084	14,360	4Q/83	0	0	0
	Subtotal			960	940	1,900
	370/145	1,790	07/71	355	340	695
	370/148	1,595	03/77	880	850	1,730
	370/155	3,250	02/71	175	52	227
	370/158	5,025	05/73	1,095	764	1,859
	370/165	6,100	06/71	35	6	41
	370/168	9,050	07/73	500	190	690
	370/195	12,450	03/71	7	3	10
	Subtotal			3,047	2,205	5,252
	360/50	1,550	08/65	190	68	258
	360/65	3,250	11/65	120	28	148
	360/67		06/66			
	360/75	6,020	01/66	20	6	26
	360/85		10/69			
	360/9X	9,150	11/67	1	1	2
	Subtotal			331	103	434
	7010	1,200	10/63	2	1	3
	7030		05/61	-	-	-
	7040/44	1,439	06/63	1	1	2
	7070/74	1,299	03/60	7	-	7
	7080	2,800	08/61	4	-	4
	7090/94	3,350	08/60	6	-	6
	Subtotal			20	2	22
	38-3	140	07/80	830	740	1,570
	38-4	150	08/81	815	730	1,545
	38-5	280	07/80	3,945	2,990	6,935
	38-7	380	06/82	150	150	300
	Subtotal			5,740	4,610	10,350
	3-4	58	06/76	60	30	90
	3-6	75	12/70	290	74	364
	3-8	100	06/75	600	800	1,400
	3-10	115	01/70	2,565	854	3,419
	3-12	173	03/76	1,135	1,150	2,285
	3-15	320	03/74	2,445	1,227	3,672
	Subtotal			7,095	4,135	11,230
IBM	4321	215	03/82	4,810	3,590	8,400
	4331-1	301	04/79			
	4331-11	370	03/82	1,450	1,170	2,620
	4331-2	573	08/80			
	4341-9	210	02/83			
	4341-10	445	03/82	580	610	1,190
	4341-1	883	10/79	4,550	4,365	8,915
	4341-11	810	03/82	2,140	1,650	3,790
	4341-12	1,050	02/83			
	4341-2	1,156	03/81			
	Subtotal			13,530	11,385	24,915
	370/115	450	04/74	185	820	1,005
	370/125	652	06/73	210	557	767
	370/135	960	05/72	390	400	790
	370/138	935	11/76	790	1,300	2,090
	Subtotal			1,575	3,077	4,652
	360/20	126	12/65	365	152	517
	360/22	141	07/71	15	19	34
	360/25	391	10/68	20	81	101
	360/30	528	06/65	415	150	565
	360/44	880	07/66	25	14	39
	360/40	895	06/65	420	145	565
	Subtotal			1,260	561	1,821
	1130	120	02/66	560	300	860
	1401	178	09/60	227	30	257
	1401 G-H	106	05/64	6	1	7
	1410	800	11/61	4	1	5
	1440	227	04/63	12	5	17
	1460	460	10/63	5	1	6
	Subtotal			814	338	1,152
	1620	129	09/60	20	11	31
	Series 1	30	11/76	29,500	11,500	41,000
	System/32	42	03/75	4,400	4,250	8,650
	System/34	64	12/77	58,000	34,000	92,000
	System/36	56	10/83	0	0	0
	8100	140	08/79	4,000	3,600	7,600
	Subtotal			95,920	53,361	149,281
	5100	13	11/65	4,300	1,000	5,300
	5110	17	02/78	13,500	2,600	16,100
	5120	15	02/80	6,500	1,600	8,100
	5150 (PC)	5	10/81	224,900	5,100	230,000
	PCXT	8	2Q/83	0	0	0
	Sys/23 Data master	13	07/81	18,700	6,300	25,000
	3741-3-4	N/A	N/A	2,600	31,700	34,300
	Subtotal			270,500	48,300	318,800

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• IBM FORMS NEW ENTRY SYSTEMS DIVISION. Just about two years after the introduction of its Personal Computer, IBM has made it the center of a whole new division. Called the "Entry Systems Division," the new group, headed by Phillip Estridge, is responsible for the PC, the Datamaster, the Displaywriter, the 5520 Administrative System and the 5280 Distributed Data System.

After laying low for nearly three years, IBM may be getting ready to start introducing some new office products, especially since its Document Content and Interchange specifications have been published. Headquartered in Boca Raton, the new division will be responsible for worldwide development, product management, and manufacturing, taking over some of the responsibilities of the Office Workstation group in Austin, Texas.

• MAINFRAMERS REPORT FIRST HALF RESULTS. IBM's push toward purchase continues to bring in the big bucks. For the first six months of 1983, worldwide revenues were up a solid 18.2%, and earnings were up 24.3%, with IBM citing "increased equipment purchases and continuing improvement in operating margins." Indeed, purchase revenues were up a whopping 46.6% and services were up 17%; rentals, however, declined 12.8%. Orders are said to be strong.

For the non-IBM mainframers, things were not so rosy. At NCR, six month revenues were up 6% with earnings up 14%; NCR reports that orders are up. CDC revenues were up 2.8%, with earnings flat. Corporate revenues at Honeywell were up 5.3%, and earnings, adjusted for capital gains, were down 7.7%. Burroughs' earnings were up 2.7%, on sales down slightly. Sperry's earnings were up 51% on revenues up fractionally. Since, for some of these firms, earnings have been weak for a while, earnings growth is not always a meaningful measure.

• NEW MICROS FROM DG, HONEYWELL. Efforts continue to scale down mini architectures both to meet the booming demand for small systems and to take advantage of microprocessor price/performance. Data General's Desktop Generation features an 8086 (for MS/DOS, and CP/M) together with a microprocessor version of its Eclipse processors running AOS and RDOS, and supporting up to four users. Four models were announced, including a version of DG's CEO office system. DG hopes to be able to move 30% of its volume through retail channels.

Honeywell is trying to get some extra mileage from the microprocessor first introduced in its Micro 6/10. Its new Micro 6/20 uses the same chip to support up to four users, which can be either terminals or 6/10s. The surprise is that the chip is also being used to power the new DPS 6/40, which Honeywell claims has 70% more power than the company's DPS 6/30 and supports 10 to 18 users. Honeywell says that the 6/40 will start using 256K chips in January.

• DEC BUYS INTO TRILOGY. Trilogy continues to look like more than just a vendor of IBM-compatible CPUs. DEC has agreed to invest $26 million for an equity position and semiconductor technology license options. DEC president Kenneth Olson notes: "Trilogy's unique approach to high performance, ultra-reliable semiconductor devices represents an important breakthrough in circuit integration and packaging that should result in significant improvements in reliability and performance. The integration of this semiconductor technology in Digital's larger computer systems is consistent with our philosophy of introducing advanced technology in high quality reliable products."

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REVIEW & FORECAST
Part I

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"The Gray Sheet"

EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

DAVID MOSCHELLA, EDITOR JULY 8, 1983 ● V/19, NO. 6 P.J. MCGOVERN, PUBLISHER

U.S. PERSONAL COMPUTER MARKET WILL SURPASS MAINFRAMES BY 1984; DEMOGRAPHICS SEEN AS ONLY MARKET BOUNDARY

"Blitzkrieg -- (lightning war); a war conducted with great speed and force."

How else can the success of the personal computer be described? In 1981, the value of personal computer shipments to the U.S. passed those of terminals; in 1982, small business computers fell; 1983 will leave the mini behind; and by 1984, the once almighty general-purpose market will succumb. Demographic ceilings may now be the only limiting factor, and they are far from being reached.

But more than just creating instant millionaires and exciting new sub-industries, the rise of the personal computer (PC) almost guarantees the information industry's future success. By dramatically expanding the user base, PCs have exponentially increased the material and cerebral resources being focused on the use of information technology. The benefits will surely follow.

The numbers tell the story. International Data Corp., publisher of EDP/IR, estimates that 1982 worldwide shipments of personal computers by U.S. manufacturers reached $5.4 billion, up 77% over 1981. Over the 1983-1987 period, the value of shipments will increase at 38.2% per year, reaching a staggering $27.2 billion by 1987. Thanks to the home market, unit growth will be even higher.

Thus far at least, only standalone word processors and small business computers have been seriously hurt by PC success, but as software improves, terminals and small minis are also feeling the heat. Among the key issues:

- Falling prices. Nearly three million units will be shipped to the U.S. home market in 1983, thanks to price cuts of up to 75% since 1981. Business system prices have held more firmly.

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- Open architecture. The success of IBM's MS/DOS-based PC and its open architecture is moving the industry away from the proprietary operating systems of Apple, Tandy and Atari. The standards are also a key to the diverse peripheral options now coming to the market.

- Distribution. Like it or not, shelf space and retailer enthusiasm may be the single most important sales factor. There are over 150 PC vendors and the average retailer carries about five.

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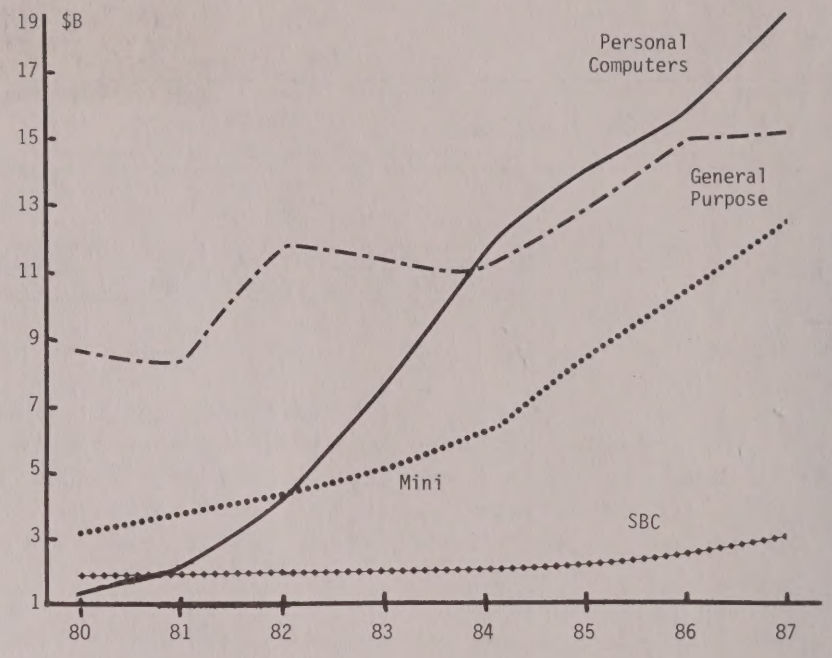
PERSONAL COMPUTERS RISE TO THE TOP; VALUE OF U.S SHIPMENTS, 1978-1987
(Copyright 1983 -- International Data Corporation)

From a manufacturer's standpoint, there is one main caveat to the chart opposite. All the figures used are based on the average retail price of the systems sold. In the case of personal computers, a substantial percentage of the retail price is absorbed by the distribution process, whereas for mainframes, almost all of the revenue accrues to the system builders. Thus, one could still argue that from the manufacturer's point of view, mainframes are still the number one revenue provider.



Market definitions and segmentations

As microprocessor technology becomes the key to systems ranging from $50 to $50,000 dollars, it has become increasingly difficult to view the personal computer market as a nice, neat package. IDC's PC category includes only those machines that are primarily sold as single-user systems. Until this year, IDC used the phrase "desktop computer," but since CPUs that sit on a desk often support multiple users, IDC has now switched to the term "personal computer."

This new definition has led to some slight revisions from the censuses of the past few years. The two most significant are that multi-user micros such as those from Altos and Fortune have been taken out, and single-station processing terminals, like those made by Datapoint and Zentec, have been included. Neither change is large enough to significantly alter the overall summary data.

IDC continues to segment the market into four separate categories -- home, educational, business/professional, and scientific. In terms of the value of U.S. shipments, five-year growth rates are: business/professional, 38.4%; home, 35.1%; scientific, 24.6%; and educational, 18.1%. The corresponding percentages for U.S. unit shipment growth are not significantly different.

Despite the high level of shipments, IDC does not believe that the business/professional market is approaching saturation. Government statistics show that by 1987, there will be some 60 million white collar workers in the U.S., and IDC is projecting a 1987 installed base of some 19 million PCs in the business/professional market. On the home front, IDC expects some 37 million machines to be installed in 1987. There are currently only 80 million U.S. households, suggesting a flattening of home market growth in the 1985-1987 period.

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APPLICATION SEGMENTATION, U.S. PERSONAL COMPUTER MARKET
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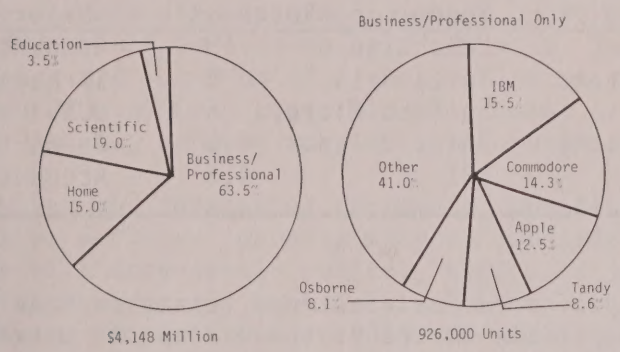

IBM jumped way up from just 6% of the market in 1981, and it should increase its lead in 1983 as production continues to ramp up. The business/professional market has been broken out separately because, although the business market is the leader in dollar value, in terms of unit shipments, the home market totally dominates with over 63% of 1982 U.S. shipments.

Because of sharp price/performance increases, the scientific market will remain strong, but vendors such as HP and Tektronix are running into competition from today's powerful 16-bit PCs. The educational market still looks relatively sluggish. There are not enough teachers who know how to use PCs, and interactive courseware is not yet available for most school subjects.

Although some sort of shakeout is inevitable, EDP/IR thinks that the demand for diverse hardware products will make it impossible for a small group of vendors to service the entire industry. Just as motor vehicles run the gamut from mopeds to 18-wheelers, there will be a spectrum of computing options across the $50 to $50,000 range. Given today's market flux, it is unlikely that any handful of vendors will be able to meet the entire market demand anytime soon.

Software patterns

Unlike the balkanized hardware world, personal computer software patterns are starting to take shape. Because of the emphasis on just a few microprocessors (the 68000 and 808X) and operating systems (CP/M, MS/DOS, and Unix), software transportability is becoming more common, and the use of proprietary operating systems for general-purpose PCs is fading. It has become a truism that software sells hardware. Among the key issues:

- User interfaces. Apple's Lisa and recent imitations such as Visicorp.'s VisiOn have emphasized visual aids. In addition, mice have been showing up on everything from executive workstations to CAD/CAM systems. Mouse vendors (featuring names such as Mouse House and Mouse Systems) are reporting very high PC vendor interest as they debate the fine points of digital, mechanical, and even optical mice. Some are already dubbing 1984 as "the year of the mouse."

- Bundling. Integrated applications packages such as on Lisa or Grid's system mark a return to bundled software pricing that could get contagious as multi-tasking options increase software complexity.

- Mini architecture. Honeywell and DEC are bringing mini architecture to the chip level. EDP/IR expects other mini vendors to follow.

- PC/mainframe links. PC access to corporate data has become a hot topic for PC vendors, software houses, service bureaus and MIS groups.

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1982 WORLDWIDE REVENUES TOP 10 INDEPENDENT PC SOFTWARE SUPPLIERS ($M)
(Copyright 1983 -- International Data Corp.)

Vendor	Revenues	Major area	Vendor	Revenues	Major area
VisiCorp	$35	Spreadsheet	Peachtree	$9	Accounting
Microsoft	32	Oper. Systems	Soft. Arts	6	Spreadsheet
MicroPro	26	Word Star	Softech Micro.	5	UCSD-P
Dig. Research	22	Oper. Systems	Info. Unltd.	4.5	Word Proc.
Ashton-Tate	14	DBMS	BPI	4.5	Accounting

Portables ... another rising star

Proving that there is still plenty of room for start-ups, firms such as Osborne, Kaypro, and Compaq have made it big in the portable computer market. Although there is clearly a demand for portable machines, EDP/IR thinks that one of the key reasons for the portable vendor's success thus far has been their low prices, often less than $2,000 for a usable system with software.

IDC breaks this market out into four sectors: handheld; true portables; plug-in portables; and transportables, with the distinctions generally coming down to dimensions, weight, and power supply (see EDP/IR, V/19, #3). Thus far, the action has been dominated by transportables, but true portables are rapidly emerging as evidenced by new products by Gavilan and Sharp. Expect many new products over the next 12 months from new and established vendors alike.

Portables are, of course, giving further impetus to the markets for small, low-cost storage, display and output technologies. Bubbles, cassettes, high-density ROMs, and sub-5.25" floppies are all being used, as is flat panel screen technology. Limited display size is still the market's biggest problem. The emphasis on miniaturization suggests a market for Japanese components.

Portables will also expand the application base. Transportables basically perform the same tasks as their PC brethren, but now a market for smaller specialized devices is rapidly emerging. Tandy's RS-100 is selling well as a word processing or data entry machine, as is a similar product from Epson. Handheld and book-size devices will meet many industry and application-specific needs.

RETAIL DOLLAR VALUE OF 1982 U.S. SHIPMENTS -- TOP 10 PC VENDORS
(Copyright 1983 -- International Data Corporation)

Vendor	1982 $ Millions	1981 $ Millions	%
IBM	836	199	320%
Apple	658	331	99
Commodore	464	96	383
Tandy	379	491	-23
Osborne	179	12	1392
Convergent Tech.	172	23	648
NEC	143	36	297
Hewlett-Packard	135	148	-9
Xerox	99	60	65
Atari	83	44	89
Other	1,000	655	53
Total	4,148	2,095	98

As the data shows, market shares and shipment levels can change dramatically within a single year. The big winners this year were IBM, Commodore, Apple, Osborne, Convergent Technologies and NEC. Among those that fell out of the top 10 in 1982 were Cromemco, Zenith, and Compucorp, while Tandy and HP suffered notable market share losses. Not all retail revenues accrue to the manufacturer.

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Technology trends and impact

Led by microprocessor and Winchester disk technology, the next few years will witness dramatic improvements in PC hardware capabilities. By 1985-86, $5,000 should be able to buy a PC with: 1-4 MIPs processing power, 1-16MB main memory; and 10-400MB of direct access storage. Additionally, support processors for graphics, text, floating point arithmetic and other specialized tasks will greatly enhance workstation capabilities.

Given the forecasted shipments, the increase in installed processing power will be enormous, causing many to conclude that the mini and/or mainframe business will necessarily suffer. EDP/IR believes that until the major vendors start to seriously push local area network technology and until today's mini software is available on PCs, the markets for PCs and minis will remain relatively discrete. As for mainframes, the use of PCs as terminals and manipulators of host data will increase the demand for central resources.

Functionally, there really isn't much difference between networked PCs sharing disk and printer resources, and a typical multi-user small system. It's mostly a matter of where the processing resources are located. The real issues are price/performance and response times. Right now, on a cost basis, a small VAX or Eclipse can compete with PC solutions while offering the advantage of being a proven system supported by a single vendor. But response times vary with application and usage patterns, and here PCs may well have an edge.

In short, EDP/IR believes that the demand for processing power will remain a continuous function over a broad price range. The price/performance of today's minis and small mainframes will increase almost as fast as that of PCs. Depending on application and type of user, the cost trade-offs will vary.

Distribution issues

After several years of squabbling over discount practices and levels of service and support, EDP/IR sees the channels of distribution starting to mature and stabilize. Apple, DEC, Commodore, and Data General are among those who've rethought their distribution strategies, and everyone has realized the importance of advertising and shelf space. IBM's biggest headache has been allocating PCs in a supply constrained environment. Some expected developments:

- OEM business will pick up in the 1984-85 period as PCs start to compete more with minis and as industry-specific markets open up.

- Retail stores will continue to carry a lot of clout with vendors, although vendors are learning to insist on quality retailers who are willing to offer reasonable service and support.

- Large users will buy direct from the vendor to get maximum discounts. Financing schemes have yet to emerge, but since today's PCs are the IBM 360s of their day, volume leasing may be attractive to large organizations, an interesting opportunity for third party lessors.

- Distributors will continue to be a key distribution channel, although their share of the market will decline. Manufacturers will increasingly sell direct to the retailer to cut out the middleman's margin. Distributors are the source of many pricing headaches.

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PERSONAL COMPUTER MARKET -- U.S.-Based Manufacturers[a]

	Number of Systems Shipped	Cumulative Number in Use	$ Million Value Shipped	$ Billion Value in Use
		WORLDWIDE		
1977	51,000	215,000	296	2.0
1978	178,000	343,000	769	2.8
1979	289,000	682,000	1,072	3.8
1980	442,000	1,124,000	1,983	5.8
1981	853,000	1,977,000	3,043	8.8
1982	3,786,000	5,763,000	5,391	14.3
1983	6,535,000	12,928,000	9,766	24.1
1984	11,161,000	24,089,000	14,967	39.0
1985	14,871,000	39,070,000	18,934	58.0
1986	19,038,000	57,998,000	21,931	80.9
1987	23,528,000	81,526,000	27,167	108.1
		UNITED STATES		
1977	32,000	101,000	230	0.9
1978	131,000	232,000	455	1.4
1979	183,000	415,000	648	2.0
1980	308,000	723,000	1,213	3.2
1981	611,000	1,334,000	2,095	5.3
1982	3,130,000	4,464,000	4,148	9.5
1983	5,076,000	10,170,000	7,565	17.0
1984	9,818,000	18,988,000	11,606	28.6
1985	11,214,000	30,312,000	14,130	42.9
1986	13,535,000	43,737,000	15,548	59.3
1987	15,813,000	59,550,000	19,012	78.3
		INTERNATIONAL		
1977	19,000	114,000	166	1.1
1978	47,000	161,000	313	1.4
1979	106,000	267,000	422	1.8
1980	134,000	401,000	770	2.6
1981	242,000	643,000	948	3.5
1982	656,000	1,299,000	1,243	4.8
1983	1,459,000	2,758,000	2,201	7.1
1984	2,343,000	5,101,000	3,361	10.4
1985	3,657,000	8,758,000	4,804	15.2
1986	5,503,000	14,261,000	6,383	21.6
1987	7,715,000	21,976,000	8,155	29.8

[a] International Manufacturers with U.S.-based sales offices are counted in U.S. totals, but not international.

NOTES TO CENSUS AND FORECAST: The value of computer system shipments shown on the red pages represents the if-sold price of the equipment at the time of sale. The value of shipments and installed base includes peripheral sales based on IDC's average system values, as shown in the census section.

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Dear Reader:

Try as we do, sometimes a few typos manage to slip through the proof-reading dragnet. Unfortunately, four such errors appeared in the red pages of the July 8, personal computer issue. Please insert these new pages to guarantee accurate data.

For readers who want to update the original pages, three of the errors are on the "Personal Computer" page. Specifically, the 1983 and 1984 U.S. unit shipments, and the 1985 U.S. cumulative number in use have been corrected. The fourth error occurs in the "Desktop Computer" table; the 1978 U.S. unit shipments should read 127,000.

We apologize for the inconvenience.

Sincerely,

David Manners

Editor

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*DESKTOP COMPUTER MARKET -- U.S. BASED MANUFACTURERS[a]

	Number of Systems Shipped	Cumulative Number in Use	$ Million Value Shipped	$ Billion Value In Use
		WORLDWIDE		
1977	34,000	50,000	244	0.5
1978	62,000	212,000	562	1.1
1979	276,000	488,000	1,036	2.0
1980	455,000	943,000	1,809	3.7
1981	827,000	1,770,000	2,948	6.8
1982	3,275,000	5,045,000	5,230	11.9
1983	6,565,000	11,610,000	9,650	21.5
1984	10,489,000	22,099,000	14,943	36.5
1985	14,026,000	36,125,000	18,706	55.3
1986	17,881,000	54,006,000	22,273	77.5
1987	22,020,000	76,026,000	25,953	103.5
		UNITED STATES		
1977	25,000	33,000	168	0.3
1978	127,000	160,000	397	0.7
1979	183,000	343,000	668	1.3
1980	327,000	670,000	1,160	2.4
1981	591,000	1,261,000	2,029	4.5
1982	2,634,000	3,895,000	4,045	8.5
1983	5,096,000	8,991,000	7,349	15.8
1984	8,101,000	17,092,000	11,457	27.3
1985	10,423,000	27,515,000	14,060	41.4
1986	12,660,000	40,175,000	16,676	58.0
1987	14,907,000	55,082,000	19,423	77.5
		INTERNATIONAL		
1977	9,000	17,000	76	0.2
1978	35,000	52,000	165	0.4
1979	93,000	145,000	368	0.7
1980	128,000	273,000	649	1.3
1981	236,000	509,000	919	2.3
1982	641,000	1,150,000	1,185	3.4
1983	1,469,000	2,619,000	2,301	5.7
1984	2,388,000	5,007,000	3,486	9.2
1985	3,603,000	8,610,000	4,646	13.9
1986	5,221,000	13,831,000	5,597	19.5
1987	7,113,000	20,944,000	6,530	26.0

[a] International Manufacturers with U.S.-based sales offices are counted in the U.S. totals, but not international.

*NOTE: IDC has made some changes in its classification scheme. The old "desktop computer" category has been replaced by the "personal computer" label. The key difference is that "personal computers" include single-station processing terminals, like those made by Datapoint, and exclude multi-user micros, such as those made by Altos. The census that follows corresponds to the "personal computer" red page. The "desktop" red page is provided for historical comparison.

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PERSONAL COMPUTER CENSUS

A personal computer is a device that is oriented for individual use. This may be for single or multi-tasking environments, but the major emphasis is for a single user. Systems may range from under $50 to more than $20,000, but the primary price range is $50 to $10,000. These systems are microprocessor based, must be programmable in a high level language, and have the capability of attaching necessary peripheral devices. Systems are placed in this category on the basis of primary competition with established members such as Apple, IBM PC, Commodore VIC 20, Texas Instruments 99/4A, and Hewlett-Packard 9800 or their successors. Board level computers are excluded from this category.

PERSONAL COMPUTER CENSUS AS OF JANUARY 1, 1983

NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE IN DOLLARS BASIC	PURCHASE PRICE IN DOLLARS AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	SHIPMENTS NEXT 12 MONTHS
Access Matrix	Access Computer	Z80-A		2,495	2,495	--/83	0	0	0	NA
All Computers, Inc. (U.S. Only)	All Computer Series	8088		995	995	--/83	0	-	0	NA
Alspa Computer	ACI-1	Z80-A		1,995	1,995	07/81	1,200	180	1,380	NA
	ACI-2	Z80-A		2,995	2,995	01/82	1,800	120	1,920	NA
	Bottom Line	Z80-A		4,500	4,500	01/83	0	0	0	500
						TOTAL	3,000	300	3,300	
A.M. Jacquard	J500	A.M. Jacquard		12,000	16,000	12/78	1,600	1,200	2,800	1,200
APF Electronics *	IMI	6800		400	1,115	11/79	14,000	0	14,000	X
Apple	Lisa	68000		10,000	10,000	--/83	0	0	0	NA
	Apple II, IIe	6502		1,330	2,500	05/77	447,900	122,100	570,000	NA
	Apple III	6502		4,240	6,000	11/80	31,100	8,900	40,000	NA
						TOTAL	479,000	131,000	610,000	
Applied Digital Data Sys.	Vantage	8080		11,000	14,000	07/76	550	400	950	X
Archives, Inc.	ABS 1	Z80		4,500	5,357	01/80				NA
	ABS 2	Z80		5,500	5,500	01/80	2,500	300	2,800	NA
	ABS 3	Z80		7,000	7,000	01/80				NA
Astrocom	Series 760	Z80		16,000	20,000	06/79	30	0	30	NA
Atari	400	6502		250	300	09/79	266,000	60,000	326,000	NA
	800	6502		550	650	09/79	116,000	24,000	140,000	NA
						TOTAL	382,000	84,000	466,000	
Athena Computer	Athena I	2NSC800		3,950	4,250	01/83	0	0	0	5,000
Basic Four	S10	Z80		5,995	5,995	06/82	2,500	0	2,500	10,000
Basis, Inc.	108	6502/Z80		3,085	3,085	06/82	25	0	25	NA
Billings Computer Co.	BC12FD	Z80		6,600	9,500	03/79	1,710	1,790	3,500	NA
	BC120F2M	Z80		9,900	12,900	03/79				NA
	BC 500	Z80		2,500	2,500	12/82	40	0	40	NA
	BC-104	8080-A		12,000	22,000	--/77	400	0	400	X
						TOTAL	2,150	1,790	3,940	
BRD, Inc. *	Small Fry	6800		7,000	10,000	04/79	50	0	50	X
	Porpoise	6800		10,000	13,000	01/78	160	5	165	X
						TOTAL	210	5	215	
Burroughs	B20	SEE CONVERGENT								
	TC 500/700	Burr		NA	NA	NA				
	TC 3000/5000	Burr		NA	NA	NA	19,250	26,500	54,758	NA
	BMT 600	Burr		NA	NA	NA				
Callan Data Systems, Inc.	Unistar 100	68000		9,950	9,950	08/82	300	0	300	1,500
Century Computer Corp.	Opus III	C-200		15,000	22,000	02/71	560	110	670	X
Canon (U.S. Only)	BX-3	6809		5,600	5,600	05/81	100	-	100	X
	CX-1	6809		4,995	7,000	05/81	500	-	500	X
						TOTAL	600	-	600	
CIE Systems	680/30	68000		10,000	16,000	11/82	4	0	4	NA
Clary Data Systems	404	Clary		6,000	30,000	01/70	100	32	132	X
Codata Systems Corp.	CTS-100	Z80-A		7,392	9,937	06/80	320	0	320	X
	CTW-300	68000		11,405	13,950	06/81	1,350	0	1,350	30
						TOTAL	1,670	0	1,670	
Codex	CDX 68/20, 40	6809		8,000	12,000	--/81	400	185	585	NA
	CDX 68/24, 44	6809		10,000	12,000	06/82				
Commodore	PET/CBM	6502		995	1,295	10/77	160,000	235,000	395,000	150,000
	VIC/20	6502A		150	150	06/81	750,000	250,000	1,000,000	1,000,000
	Super Pet	6502B		1,995	1,995	07/81	50,000	20,000	70,000	50,000
	64	6510		400	400	08/82	50,000	0	50,000	300,000
	128	6510		795	795	03/83	0	0	0	120,000
	B, BX700	6509		1,695	2,995	07/83	0	0	0	120,000
						TOTAL	1,010,000	505,000	1,515,000	1,740,000
Compal	8100	8080		12,000	12,000	12/76	400	10	410	X
	EZ Type	Z80		8,995	9,995	03/81	150	5	155	200
						TOTAL	550	15	565	
Compaq Computer Corp.	Compaq	8088		2,995	2,995	02/83	0	0	0	50,000

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Compucorp	625	Z80		5,000	8,500	06/77	200	500	700	X
								4,315	6,900	
	655	Z80		4,000	6,500	04/79	2,585			
	665	Z80		5,000	7,000	04/79	1,130	2,070	3,200	
	675	Z80		7,000	9,078	06/79	4,000	6,600	10,600	
	685	Z80		11,000	11,600	05/81	690	810	1,500	
	685E	Z80		13,600	13,600	05/82	390	210	600	
	686	Z80		15,995	15,995	05/82	195	105	300	10,000
	745	Z80		4,495	4,495	08/82	195	105	300	
	775	Z80		7,400	7,400	01/83	0	0	0	
	785	Z80		10,200	10,200	01/83	0	0	0	
	790	Z80		11,700	11,700	01/83	0	0	0	
	Simplifier	Z80		4,995	5,700	07/82	975	525	1,500	
						TOTAL	10,360	15,240	25,600	
CompuCorp *	402	CompuCorp		13,000	15,000	01/76	15	455	470	X
	450	CompuCorp		20,000	22,000	04/76	40	115	155	X
						TOTAL	55	570	625	
Computek	Display 8			3,000	6,000	--/81	900	0	900	700
Computer Data Systems *	Versatile 4	8085		3,800	4,500	11/77	700	150	850	X
	Versatile 3B	8085		4,900	5,500	11/77	250	50	300	X
						TOTAL	950	200	1,150	
Computer Devices	DOT	8088		2,995	3,995	04/83	0	0	0	7,000
Computer Hardware, Inc.	4800	CHI	a	8,850	10,500	04/81	10	0	10	5
Computer Interface Tech.	Pense System	Microengine		5,295	8,000	11/79	400	355	755	X
Convergent Technologies	AWS	8088		5,795	6,795	11/81	400	100	500	X
	IWS	8086		8,400	16,000	10/80	5,000	1,000	6,000	NA
	AWS Turbo	8086		4,790	6,900	01/82	17,000	3,000	20,000	NA
	AWS Color Turbo	8086		12,190	12,990	02/83	0	0	0	NA
						TOTAL	22,400	4,100	26,500	
Burroughs	B20	8088		10,000	14,000	06/82	1,800	1,800	3,600	NA
NCR	Worksaver	8086		7,000	8,500	04/82	900	100	1,000	NA
Computer Shop	Star Lite	Z80-A		2,695	2,695	--/83	0	0	0	4,800
Corona Data Systems	Corona PC	8088		2,595	2,995	01/83	0	0	0	NA
	Corona Portable PC	8088		2,395	2,795	04/83	0	0	0	20,000
Corvus Systems	Concept	68000		4,995	7,000	05/82	1,000	1,000	2,000	NA
Cromemco	System Zero/D	Z80-A		2,995	4,990	12/80				NA
	System Zero	Z80-A		995	2,990	12/80	23,500	11,500	35,000	NA
	System One	Z80-A		3,995	7,585	12/81				NA
	System Three	Z80-A		5,995	10,943	08/77				NA
	C-10	Z80-A		1,785	2,500	--/83	0	0	0	NA
						TOTAL	23,500	11,500	35,000	
Cyber Systems, Inc.	CYKEY 9910	Z80		7,000	9,000	06/81	15	0	15	X
	CYKEY 9980	Z80-A		6,999	6,999	01/82	15	0	15	15
	CYKEY 9990	Z80-A		7,282	7,282	01/82	5	0	5	25
						TOTAL	35	0	35	40
Datamac Computer Sys.	1200 Series	Z80		2,295	4,195	07/81	200	70	270	X
	800 Series	Z80		2,295	3,500	07/82	150	50	200	1,500
						TOTAL	350	120	470	
Data Technology, Inc.	Associate	Z80		3,450	3,450	06/79	1,500	1,500	3,000	9,000
	Associate +	Z80		3,850	3,850	03/80	350	250	600	4,000
	Associate	Z80		4,950	4,950	01/81	60	85	145	2,000
						TOTAL	1,910	1,835	3,745	15,000
Datapoint	1100	Datapoint		7,000	12,000	--/77	16,000	8,000	24,000	X
	2200	Datapoint				09/77				
	1500	Datapoint		6800	9100	--/73	7,500	2,500	10,000	X
	1560	Z-80A		3,195	6,500	11/82	990	10	1,000	
	1800	Datapoint		7,500	12,000	--/75	7,500	2,500	10,000	X
						TOTAL	15,990	5,010	21,000	
Dataview Corporation	200 Series	Z80		2,295	2,295	11/81	200	0	200	200
	300	Z80		5,995	5,995	11/81	200	0	200	200
						TOTAL	400	0	400	400
Digicomp Research	Delphi-100	Z80, 68000		14,000	17,000	07/82	12	0	12	50
Digilog Business Sys.	1000	Z80-A		2,995	2,995	11/80	1,800	400	2,200	1,000
	1016	Dual 8186,Z80		3,995	3,995	02/83	0	0	0	150
	1500	Z80-A		4,995	4,995	07/81	1,000	300	1,300	1,500
	1516	Dual 8186,Z80		5,995	5,995	02/83	0	0	0	150
	2000	Dual Z80-A		8,400	8,400	09/80	200	0	200	X
						TOTAL	3,000	700	3,700	2,800
Digilog, Inc.	7120	Dual Z80-A		8,400	8,400	03/79	0	1,500	1,500	X
	7130	Dual Z80-A		10,500	10,500	07/81	0	2,000	2,000	X
						TOTAL	0	3,500	3,500	
Digital Equipment Corp.	Mini MINC	LSI-11		9,900	11,000	10/79	5,350	820	6,170	1000
	Data Sys. 150	LSI-11		10,900	15,000	03/79	1,200	900	2,100	X
	VT100 (18XKit)	Z80		5,000	5,000	01/82	2,900	100	3,000	5,000
	Decmate II	6120		3,740	3,790	01/83	0	0	0	
	Rainbow 100	Z80, 8088		3,245	3,245	--/82	1,050	100	1,150	50,000
	325	F11		3,995	3,995	--/82	1,150	100	1,250	
	350	F11		4,995	4,995	--/82				
						TOTAL	11,650	2,020	13,670	56,000
Digital Microsystems	DSC-2	Z80-A		4,995	5,895	11/77	5,140	2,210	7,350	X
	DSC-2585	Z80-A		9,950	9,950	06/78	300	0	300	X
	DSC-3	Z80-A		5,495	15,000	11/80	1,015	1,435	2,450	1,500
	DSC-4	Z80-A		6,950	10,000	10/80	210	235	445	
	DMS-3F	Z80-A		3,995	3,995	04/82	50	50	100	200
	DMS-15	Z80-A		7,495	7,495	01/83	0	0	0	1,500
						TOTAL	6,715	3,930	10,645	3,200
Durango Systems	F85, 700 Series	8085		7,500	12,536	10/78	2,000	2,000	4,000	NA

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NAME OF MANUFACTURER	COMPUTER MODEL	PROCESSOR MODEL	NOTES	PURCHASE PRICE IN DOLLARS BASIC	PURCHASE PRICE IN DOLLARS AVERAGE	DATE OF FIRST INSTALLATION	NUMBER INSTALLED IN U.S.	NUMBER INSTALLED OUTSIDE U.S.	TOTAL NUMBER INSTALLED	SHIPMENTS NEXT 12 MONTHS
Eagle Computers	Eagle II	Z80-A		2,995	2,995	11/81	5,700	300	6,000	NA
	Eagle III	Z80-A		3,995	3,995	02/82	1,900	100	2,000	
	Eagle IV	Z80-A		5,995	5,995	02/82	1,400	100	1,500	
						TOTAL	9,000	500	9,500	
Epson America	QX-10	Z80		2,495	3,000	03/83	0	-	0	NA
(U.S. Only)	HX-20	6301		795	795	10/82	8,000	-	8,000	NA
						TOTAL	8,000	-	8,000	NA
Exidy Systems, Inc. *	Sorcerer	Z80		1,495	2,890	08/78				X
	80/1	Z80		1,495	5,500	03/80	10,000	10,000	20,000	X
	80/2	Z80		1,495	7,295	03/80				X
Facit/Dataroyal	DTC	Z80-A		3,995	3,995	12/81	700	-	700	1,500
Findex, Inc. *	100	Z80		4,500	5,980	07/79	24	6	30	X
	128	Z80		8,230	8,980	--/80	0	1	1	X
	234	Z80		6,980	8,500	01/81	195	625	820	X
						TOTAL	219	632	851	X
Franklin Computer	ACE 1000	6502		1,395	1,395	08/82	16,000	1,000	17,000	120,000
	ACE 1200	6502		2,495	2,495	03/83	0	0	0	60,000
						TOTAL	16,000	1,000	17,000	180,000
Gavilan Computers	Gavilan	8088		4,990	4,991	--/83	0	0	0	NA
General Robotics	Polaris	LSI-11		13,000	13,000	04/78	0	100	100	X
						TOTAL	0	100	100	
Gnat Computers, Inc. *	System 10	Z80-A, 8085		4,650	6,100	12/79	150	50	200	X
	System 10M	Z80-A, 8085		5,450	7,000	10/80	80	20	100	X
	System 10H	Z80-A, 8085		8,350	8,350	07/81	5	0	5	X
						TOTAL	235	70	305	X
Grid Systems	Compass Cptr.	8086, 8087		8,100	9,210	12/82	38	2	40	5,000
Hardy Computer Corp.	801	Z80-A		1,350	3,000	06/80	450	400	850	NA
Harris	804	NA		NA	NA	NA	2,850	1,800	4,650	X
Hewlett-Packard	9816A/S	68000		3,650	5,000	11/82	400	600	1,000	9,000
	9825	HP		5,900	10,900	01/76	11,540	19,760	31,300	500
	9826A/S	68000		9000	11,803	06/81	3,200	4,800	8,000	3,500
	9830	HP		4,900	16,500	11/72	5,000	5,000	10,000	X
	9835	HP		9,000	13,200	12/78	3,540	4,460	8,000	500
	9836A/S	68000		12,000	14,500	01/81	2,050	2,600	4,650	6,000
	9845	HP		12,000	28,800	11/77	6,700	9,800	16,500	1,200
	83	HP		2,250	2,550	01/81	2,500	2,500	5,000	1,000
	85	HP		2,750	3,550	01/80	28,000	29,450	57,450	19,000
	86	HP		1,795	3,700	07/82	5,000	5,000	10,000	20,000
	87	HP		2,495	4,790	03/82	4,000	4,000	8,000	15,000
	120	Z80		2,775	2,775	12/82	550	0	550	6,500
	125	Z80		4,950	6,200	09/82	7,150	950	8,100	4,500
						TOTAL	79,630	88,920	168,550	86,700
HIS	6/10	HIS		3,995	5,000	--/83	0	0	0	10,000
	SPD10/20, 10/25	NA		6,090	12,000	06/70	6,500	3,700	10,200	X
IMSAI *	VDP-40	8085		5,300	5,300	--/78	380	20	400	X
	VDP-80	8085		7,800	7,800	--/77	670	130	800	X
						TOTAL	1,050	150	1,200	
Information Support Systems, Inc. *	Voyager I	8085		4,995	4,995	04/81	48	0	48	X
	Voyager II	8085		9,995	9,995	04/81	48	0	48	X
						TOTAL	96	0	96	X
IBM	5100	IBM		6,300	13,000	11/75	4,300	1,000	5,300	X
	5110	IBM		9,900	17,000	02/78	13,500	2,600	16,100	X
	5120	IBM		9,340	15,000	02/80	6,500	1,600	8,100	X
	5150 (PC)	8088		1,565	4,500	10/81	224,900	5,100	230,000	NA
	PCXT	8088		4,995	7,500	2Q/83	0	0	0	NA
	Sys/23 Datamaster	8085		9,830	12,530	07/81	18,700	6,300	25,000	NA
	3471-3-4	IBM		NA	NA	NA	2,600	31,700	34,300	X
						TOTAL	270,500	48,300	318,800	
ICL	1500	ICL		NA	NA	NA	1,730	-	1,730	X
Infotecs	IMP	IM 6100		10,000	15,000	09/77	855	128	976	NA
Intertec Data Systems	Super Brain	Z80-A		2,495	2,795	10/79	17,130	10,370	27,500	NA
	Super Brain QD	Z80-A		3,495	3,695	04/80				NA
	Compustar	Z80-A		1,995	3,500	01/81	6,080	4,120	10,200	NA
						TOTAL	23,210	14,490	37,700	
Konix International Corporation	System 80	Z80		3,700	4,000	06/78	53	14	67	X
	System 81	Z80		3,700	4,100	01/80	18	1	19	X
						TOTAL	71	15	86	
Lanier	Computer EZ	Z80		7,495	9,200	07/81	3,450	-	3,450	NA
Mad Computers	Mad 1	80186		3,000	6,000	06/83	0	0	0	NA
Micro Business Applications	Micron 740	Z80, 8085		25,000	30,000	03/80	29	0	29	X
Micro Expander	Expander	Z80		2,200	4,250	11/81	60	40	100	X
Micro Source	M-600P-Voyager	Z80-A		3,900	3,900	06/81	3,900	100	4,000	20,000
Micro Technology Unlimited	MTU130 Series	6502, 68000, Z80		3,350	4,450	09/81	1,100	100	1,200	NA
Microstar Inc *	Microstar I, II	Z80		13,000	18,000	12/78	5	0	5	X
Mohawk	21/10	Z80		7,000	10,000	NA	5,400	1,760	7,160	NA
Momentum Computer	Minimax	6502		6,950	6,950	01/80	320	830	1,150	X
	32	68000		10,000	13,500	03/82	30	45	75	300
	32E	68000		14,000	17,000	01/83	0	0	0	
	32/4	68000	b	10,000	13,500	12/82	1	0	1	500
						TOTAL	351	875	1,226	800
Monroe Systems for Business	OC 8820	Z80-A		4,385	4,385	12/81	1,500	800	2,300	2,500
	EC 8800	Z80-A		3,295	3,295	12/81	500	200	700	
						TOTAL	2,000	1,000	3,000	2,500

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Morrow Designs	Decision I	Z80		5,000	7,000	04/81	220	80	300	NA
	Microdecision			1,500	2,400	09/82				
Multitech Systems	MT 500	Z80		4,795	4,995	12/81	110	10	120	X
NBI, Inc.	System One	6810		13,000	13,000	Q1/842	-	-	-	NA
NCR	7500	NCR		7,500	9,500	--/79	2,000	4,100	6,100	500
	Decision Mae	Z80-A, 8088		2,680	4,000	04/83	0	0	0	NA
						TOTAL	2,000	4,100	6,100	
	Worksaver	SEE CONVERGENT								
NEC Information Sys. (U.S. Only)	205	NEC		6,500	11,039	07/80	600	-	600	X
	200	NEC		4,500	6,990	06/82	850	-	850	NA
	PC 8000	NEC		995	2,300	05/81	25,000	-	25,000	NA
	APC	8086		3,298	4,930	07/82	6,000	-	6,000	NA
						TOTAL	32,450	-	32,450	
Non-Linear	Kapro II	Z80		1,795	1,795	03/82	5,600	1,400	7,000	80,000
	Kapro 10	Z80-A		1,995	2,795	06/83	0	0	0	
						TOTAL	5,600	1,400	7,000	
Northern Telecom	340	NA		NA	NA	NA	18,108	39,500	57,608	NA
	350	NA		NA	NA	NA				
	405	NA		NA	NA	NA				
	530	NA		NA	NA	NA				
North Star Computers	Advantage Series	Z80-A		3,995	4,295	09/81	10,900	2,000	12,900	
Northwest Microcomputers *	IVMS 85/P	8085		7,200	7,200	01/78	25	3	28	X
Novell Data Systems	Nexus I	Nexus		12,000	12,000	04/81	578	248	826	NA
Octagon Computer Systems	Octagon 8/6	Z80/8088		4,695	6,297	04/83	0	0	0	NA
Odell Ind. *	System 85	8085A		10,450	15,550	06/78	30	0	30	X
Olivetti	P-6060	Olivetti		13,000	13,000	--/77	1,000	-	1,000	X
(U.S. Only)	P-6066	Olivetti		11,600	11,600	03/81	1,600	-	1,600	NA
						TOTAL	2,600	-	2,600	
Olympia USA (U.S. Only)	Portable Cptr.	6502		2,380	2,495	06/82	650	-	650	1,500
Ontel	OP-1	8085		5,000	6,500	--/74	22,000	18,000	40,000	NA
	150X	8085A		4,600	6,500	06/81	5,000	5,000	10,000	NA
						TOTAL	27,000	23,000	50,000	NA
Osborne Computer Co.	Osborne I	Z80		1,795	1,795	07/81	106,700	20,300	127,000	120,000
	Executive	Z80		2,500	2,500	--/83	0	0	0	NA
						TOTAL	106,700	20,300	127,000	120,000
OSM Computer Corp.	Zeus Series	Z80		4,595	6,595	01/80	500	200	700	NA
Otrona Corporation	Attache	Z80-A		3,995	3,995	03/82	4,700	0	4,700	20,000
Panasonic Co.	JD 850	8085		10,500	11,500	06/80	20	-	20	X
(U.S. Only)	JD 740	8085		7,000	9,500	10/81	5	-	5	X
	JR 800	6802		499	499	09/83	0	0	0	NA
						TOTAL	25	-	25	
Pentel of America Ltd. (U.S. Only)	PS-850S	Z80-A		13,000	13,000	1Q/83	0	0	0	NA
Peripheral Systems	Eagle	Z80-A		3,495	3,550	02/83	0	0	0	30,000
Perkin Elmer	3500	NA		NA	7,000	--/78	3,590	1,580	5,170	NA
Pertec Computer Corp.	MITS 300/25/55	8080		8,080	13,800	--/77	1,100	175	1,275	X
	3205	68000		5,000	5,000		0	0	0	NA
						TOTAL	2,770	3,045	5,815	
Polymorphic Systems	8813	8080		4,700	5,801	09/77	2,650	500	3,150	X
	Twin Systems	8080		6,000	7,500	07/78	90	85	175	X
	88HD	8080		10,000	15,000	03/81	50	75	125	X
						TOTAL	2,790	660	3,450	
Processor Industry *	Sol I, II, III, IV	8080A		3,000	6,000	--/77	4,500	500	5,000	X
Psytek, Inc.	Psytek 770	Z80		4,750	7,200	07/79	30	5	35	X
Quasar Data Products	QDP 100	Z80-A		4,695	4,695	01/80	2,800	200	3,000	NA
	QDP 200	Z80-A		2,995	2,995	12/82	225	25	250	NA
	QDP 300	Z80-B		3,995	3,995	02/83	0	0	0	NA
						TOTAL	3,025	225	3,250	
Quay	900 Series	Z80		4,995	9,000	09/79	1,200	300	1,500	NA
	500 Series	Z80		2,495	3,215	03/80				NA
R2E of America	X Product	Z80		8,500	8,500	01/79	270	-	270	NA
(U.S. Only)	XM	Z80		NA	20,000	03/82	20	20	40	NA
						TOTAL	290	20	310	
Racal Milgo	4000 Series	NA		3,800	6,750	06/80	8,200	-	8,200	NA
Randal Data Systems *	R-100 Series	Randal		14,000	17,000	10/75	257	13	270	X
Retail Sciences	Clerk 300	Z80		12,000	12,000	08/79	85	50	135	X
Sanyo	MBC-2000	8085		3,495	3,495	05/82	900	-	900	NA
(U.S. Only)	MBC-3000	8085		6,495	6,495	06/82	2,000	-	2,000	NA
	MBC-1000	Z80-A		1,995	1,995	05/82	16,000	-	16,000	NA
	MBC-555	8088		995	995	09/83	0	-	0	NA
						TOTAL	18,900	-	18,900	NA
Scientific Data Sys., Inc.	SDS 400 Series	6502		5,500	8,400	03/79	800	80	880	500
	SDS 4000	6502		7,400	7,400	05/83	0	0	0	300
						TOTAL	800	80	880	800
Seattle Computer	Gazelle	8086		5,995	5,995	09/82	60	2	62	500
Seequa	Chameleon	8088		1,995	1,995	--/82	290	10	300	8,000
Sharp Electronics Corp.	YX 3200-100	Z80-A		3,495	5,000	05/81	500	-	500	800
(U.S. Only)	YX 3200-200	Z80-A		4,995	7,000	01/82	250	-	250	
						TOTAL	750	-	750	800
Sinclair (U.S. Only)	ZX/80, 81	NA		100	150	01/82	500,000	-	500,000	NA
Solid State Technology	8185	8085A								
Solo Systems, Inc.	1116	68000		35,000	35,000	06/83	0	0	0	200
Sony Corporation (U.S. Only)	SMC-70	Z80-A, 8086		1,475	3,600	10/83	0	-	0	NA

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Sord (U.S. Only)	Sorius M23P	Z80-A		2,595	2,595	--/83	0	-	0	NA
Space Byte Computer *	DBM/1, /2	8085,Z80		6,000	15,000	07/78	65	10	75	X
Sperry Univac	UTS40	Sperry		4,000	9,500	--/81	5,575	9,250	14,825	NA
STM Electronics	Pied Piper 1	Z80-A		1,299	1,299	--/83	0	0	0	NA
Sumicon, Inc.	System 830	Z80-B		6,695	7,495	01/83	0	0	0	NA
Systel Computers, Inc.	Model 11	8085, Z80		8,950	8,950	01/81	50	200	250	X
	Model 15	8085, Z80		9,950	9,950	01/81				X
Tandy/Radio Shack	TRS-80/I	Z80		499	1,000	09/77	247,500	27,500	275,000	X
	TRS-80/II	Z80		3,450	6,500	07/79	102,000	14,000	116,000	NA
	TRS-80/III	Z80		700	2,000	09/81	79,000	14,000	93,000	NA
	TRS-80/IV	Z80		999	1,999	--/83	0	0	0	NA
	TRS-80 Color	6809		299	399	09/81	88,000	24,000	112,000	NA
	TRS-80/16	68000		4,999	9,000	--/82	8,000	1,000	9,000	NA
	TRS-80-100	80C85		799	850	--/83	0	0	0	NA
						TOTAL	524,500	80,500	605,000	
Tano Corp.	Outpost II	6800		4,995	5,575	08/78	1,320	160	1,480	NA
	Outpost 7	6800		3,000	4,000	08/77	180	20	200	X
						TOTAL	1,500	180	1,680	
Tektronix	4051	6800		5,995	12,500	12/75	9,620	5,080	14,700	NA
	4052	Tek		9,950	16,500	07/79	3,920	1,880	5,800	NA
	4054	Tek		20,100	22,500	07/79				
						TOTAL	13,540	6,960	20,500	
Telcon Industries, Inc.	Zorba	Z80-A		1,995	1,995	10/82	950	0	950	65,000
		Z80-A		2,395	2,395	04/83	0	0	0	
						TOTAL	950	0	950	65,000
Teleram Communications Corporation	T-3000 Series	Z80		2,995	3,200	01/83	0	0	0	20,000
Televideo Systems, Inc.	TS 801	Z80		3,295	3,295	09/81	1,540	380	1,920	X
	TS 803	Z80-A		2,495	2,495	03/83	0	0	0	NA
	TS 816	Z80		12,995	12,995	02/82	360	90	450	2,800
	TS 800A	Z80		1,695	1,695	09/81	6,840	1,710	8,550	20,000
	TS 802	Z80		3,495	3,495	12/81	2,085	520	2,605	6,000
	TS 802H	Z80		6,995	6,995	12/81	5,300	1,330	6,630	12,000
	TS 806	Z80		7,195	7,195	09/81	2,080	520	2,600	5,500
	TS 1603	8088		3,495	3,495	04/83	0	0	0	NA
						TOTAL	18,205	4,550	22,755	
Texas Instruments	99/4	TI9900		650	1,000	11/79	19,850	150	20,000	X
	99/4A	TI9900		150	150	07/81	495,500	4,500	500,000	1,000,000
	742	NA								
	770	NA		5,745	10,000	--/77	11,050	30,500	41,550	X
	771	NA								
						TOTAL	526,400	35,150	561,550	1,000,000
Toshiba America (U.S. Only)	T-100	Z80		2,400	3,000	11/82	200	-	200	1,200
	T-200	8085		3,750	5,500	08/81	400	-	400	300
	T-250	8085		4,750	7,000	08/81	1,000	-	1,000	1,200
						TOTAL	1,600	-	1,600	2,700
Vector Graphic	System B, MZ	Z80		4,314	5,400	01/79				
	1600	Z80		3,995	3,995	08/80	12,850	3,096	15,946	2,600
	2800	Z80		7,295	7,295	07/80				
	2600	Z80		5,195	5,195	03/81				
	Memowrite	Z80		8,950	8,950	01/79	300	100	400	X
	3100	Z80		5,795	5,795	07/81				
	3105	Z80		8,495	8,495	07/81	1,281	225	1,506	250
	3032	Z80		12,795	12,795	05/81				
	3005	Z80-B		5,495	5,495	01/82	887	66	953	1,200
	Vector 4/20	Z80/8088		4,750	4,750	09/82	849	236	1,085	5,000
	Vector 4/30	Z80/8088		5,995	5,995	09/82	1,085	268	1,353	5,000
						TOTAL	17,252	3,991	21,243	14,050
Victor	9000			4,995	8,000	04/82	5,000	15,000	20,000	80,000
Wang Laboratory	PCS 1	Wang 2200		5,400	8,000	04/76	840	320	1,160	X
	PCS 2	Wang 2200		4,800	10,145	04/77	3,045	1,960	5,005	X
	PCS 3	Wang 2200		6,500	9,000	04/80	25	10	35	X
	Wang PC	8086		2,695	2,695	01/83	0	0	0	40,000
						TOTAL	3,910	2,290	6,200	40,000
Wave Mate *	Series 2000	6800		2,395	3,000	01/79	100	100	200	X
Wicat	System 150	68000		8,500	8,500	10/81	300	150	450	600
Xerox	510	8085A		15,000	17,000	09/79	1,550	2,550	4,100	X
	515	8085A		5,700	6,300	03/81	420	2,050	2,470	X
	820	Z80	c	2,995	4,995	06/81	30,000	6,000	36,000	NA
	16/8	8086,Z80A		3,995	4,000	08/83	0	0	0	NA
						TOTAL	31,970	10,600	42,570	
Zeda Computers Int'l	Zeda 580	Z80		6,038	6,250	06/79	500	300	800	NA
	Zeda 520	Z80		3,995	3,995	02/81	75	0	75	NA
						TOTAL	575	300	875	
Zenith	Z89	Z80, 8080		2,000	4,000	10/79	25,000	25,000	50,000	NA
	Z90	Z80, 8080		2,499	4,166	10/81				NA
	ZF-1100	8085/8088		2,899	5,000	09/82				NA
	ZW-100	8085/8088		5,799	7,000	03/83	0	0	0	NA
						TOTAL	25,000	25,000	50,000	
Zentec	Series 2000	8085A		8,950	8,950	03/83	0	0	0	NA
	9003, ZMS	8085A		2,395	NA	--/75	29,300	1,231	30,531	X
	8000	8085A		17,500	NA	4Q/81	5,800	9	5,809	NA
	Cobra	8085A		1,250	NA	4Q/82	333	3	336	NA
	8031	8085A		14,500	NA	3Q/83	0	0	0	NA
	Peacock	8086		6,995	NA	5Q/83	0	0	0	NA
						TOTAL	35,433	1,243	36,676	
Zilog	MCZ1	Z80		5,000	6,000	--/77	1,330	2,670	4,000	100
	MCZ2	Z80		11,500	11,500	06/80	1,020	830	1,850	50
						TOTAL	2,350	3,500	5,850	150

	U.S.	International	World
TOTAL OF ABOVE	4,455,758	1,287,234	5,742,992
TOTAL OTHER VENDORS	8,400	11,600	20,000
TOTAL	4,464,158	1,298,834	5,762,992

Notes: a Corporate name was changed from Business Machines.
b Corporate name was changed from Computhink, Inc. - December, 1982.
c Xerox sells the 510 model in addition through Diablo under the Model 3000 name; however, the whole installed base is credited to Xerox.
* Not currently active in manufacturing or marketing desktop computers.
NA Data is not available.
X Model not in new production.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

DAVID MOSCHELLA, EDITOR JULY 5, 1983 ● V/19, NO. 5 P.J. MCGOVERN, PUBLISHER

HP's world view -- page 3

SIERRA SPECULATION HEATS UP AS HIGH END FUTURE LOOKS BRIGHT; PCMS TALK STRATEGY

IBM's 308X series has been in volume shipments for less than two years, but already speculation has begun as to when its replacement -- code named Sierra -- will be announced and shipped. If the rising tide of rumor mongering seems to have arrived even earlier than for previous generations, it is probably due to a sense of renewed enthusiasm for the high end, IBM-compatible CPU market.

Record shipments of high-end systems have turned reams of "mainframes are dead" articles into so many pieces of trash. IBM and the PCMs estimate the power requirements of large customers are growing at some 35%-50% per year, compared to historical increases in the 20%-30% range. What's going on?

There seems to be little doubt that the growth in the IBM world is coming at the expense of the Bunch (Burroughs, Univac, NCR, CDC, Honeywell). In fact one can argue that the power growth for the Bunch installed base has slowed enough to explain much of the IBM base's gain. It's not that Bunch machines are being replaced; it's that many new applications are being built for IBM machines.

Additionally, three new market forces will substantially add to MIPS requirements over the next five years. Increases in on-line applications and terminals will join MIP munchers such as MVS/XA and the new Database 2 software in forcing huge increases in CPU power, and implying a bright future for the high-end IBM market at least through the next generation of CPUs. Among the key points gleaned from recent visits to National Advanced Systems and Amdahl:

- Sierra. Amdahl is looking for shipments in mid-1985. NAS expects an announcement either late this year or early next year, with shipments about one year later. ECL logic chips are expected.

- Trilogy. Amdahl and NAS agree that Trilogy's planned performance is way beyond anyone else's, but the company is breaking so much new technological ground that its ability to deliver is questioned.

- Pricing. Most of IBM's discounting has come in the government/education market and in Europe where IBM wants to maintain market share.

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The view from NAS and Amdahl

After a tough 1982 (see Vol. 19, No. 2), the PCMs are riding the upswing of this highly cyclical business. Both sales and orders are healthy. NAS expects to go over the $300 million mark this year, up from $240 million in 1982, while Amdahl will approach the $600 million level. NAS expects the high-end IBM market to grow at about 15% per year, while it hopes to grow at twice that rate.

Both companies agree that IBM has become more aggressive, but they note that most of the discounting has been limited to the government and university markets, the latter of which IBM has virtually locked up. In Europe, IBM has been keeping prices low on a country-by-country basis. The PCMs say that IBM is willing to take lower profit margins there to preserve market share, while hiding the price cuts behind the smokescreen of "currency effects."

Europe has become a major PCM battleground, and IBM is sending a message to U.S. and Japanese PCMs that profits will be hard to come by. Olivetti has all but stopped marketing Hitachi machines, but BASF is still serious and competes directly with NAS in some European countries. The Siemens/Fujitsu combination has done very well in Germany, but NAS does not think that ICL/Fujitsu will prove as formidable; Amdahl and Siemens compete head on in Europe. Amdahl maintains that its 5860 is very different from Fujitsu's 380; NAS disagrees.

NAS has become increasingly important to Hitachi, and it is now taking some 50% of Hitachi's 9000 class CPUs, and a substantial share of its 6600s. In 1982, Amdahl purchased $100 million worth of Fujitsu "computer subassemblies." The availability of Japanese disk and tape systems allows NAS and Amdahl to compete in packaged system bids. Neither uses thin film heads yet, but Hitachi probably will make the jump when IBM brings out double density 3380s.

Neither company expects IBM to ship many 3084s. NAS sees it as essentially a clever 3081 discounting scheme, while Amdahl notes that IBM has never had much success with multiprocessors. The general thinking is that the lure of Sierra will keep most users from going to 3084s. As for the 3083, both companies agree that thus far the big sellers have been the smaller 3083E and B, not the 3083J. NAS doesn't see field upgrades as a key factor; Amdahl does.

As for technology, neither company expects to move to a packaging technology like IBM's thermal conduction modules, which they see as a sophisticated kluge that is expensive to manufacture. Only IBM's vast scale economies allow it to remain the lowest cost CPU builder, they say. Both companies did suggest that the days of air-cooled machines may be numbered. They also maintain that /XA is not a serious problem. NAS has about 20 people working on /XA; Amdahl puts the figure at 20-40. The PCMs like to view /XA as just another MVS release.

When asked about new entrants Trilogy and Storage Technology, Amdahl and NAS expressed doubts. Amdahl noted that the mainframe business is getting very expensive, and wonders how many PCMs the market will support. Amdahl spent about $50 million to develop the 470; $200 million for the 5860; and the next generation could reach $400 million. Trilogy will, it thinks, need a lot more money. NAS believes that STC may have missed the window in the mid-range market.

Although its 1100 system has not been a big hit, NAS sees opportunities in the DDP market, and may take a workstation approach using National Semi's 16000 microprocessor. Amdahl seems less interested in DDP, but doesn't rule it out.

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HEWLETT-PACKARD LOOKS TO PCS, SOFTWARE AND MANUFACTURING; FOCUS IS ON DISTRIBUTED NETWORK SOLUTIONS

Life at Hewlett-Packard has been good the last few years. Growth and profitability have not been snuffed out by the recession, and the company consistently turns up on lists of America's best managed corporations. By generally adhering to an organizational philosophy of no "me too" products, HP has managed to carve out a number of profitable niches.

Ironically, it is this decentralized, market-driven history that stands between where HP is today and where it wants to be for the rest of the decade. As the industry moves toward networks of compatible systems, HP finds itself with a fragmented product line not easily reconciled. Two different families of minicomputers and four different lines of personal computers complicate marketing and networking alternatives. That such problems are not unique to HP does not make their resolution any less vital.

HP's plan for the future is clear. It will concentrate on two main lines of business -- manufacturing systems and personal computers. HP claims that it will soon pass IBM in revenues from manufacturing systems, and, although it has kept a low PC profile to date, it hopes to become "at least number two" in personal computers. The common thread to both markets is that success is dependent on two key areas: application software and networking solutions.

This last point has led HP to refer to itself as a "software company," and it says a full 70% of its R&D is going to software development. At a time when most large companies are farming out applications software to third parties, HP is trying to take advantage of in-house software efforts, especially in the manufacturing/engineering market. Some other points of note:

- No big systems. HP says it does not want to build any systems that cost more than $350,000. It believes that by 1987 such systems will account for just 16% of the market's revenues, down from 34% today.

- Turnkey systems. HP expects a sharp increase in the number of its systems that go out with applications software and sees its software revenues growing at 100% per year.

- Operating systems. The company's engineering systems will be based on Unix, as will its commercial workstations if the market allows.

- Mini on a chip. A desktop version of the HP 3000 is in the works, but don't expect its 32-bit chip to appear in low-cost PCs.

Like almost every one else in the industry, HP is reshaping its organization to cope with the personal computer and the shift toward networked systems. Its PC efforts are being consolidated and its peripheral and networking groups have been merged. But redrawing the organizational lines is the easy part, the real task is determining what to do with autonomous, profitable product lines. Much of HP's product integration strategy has yet to be made clear.

One thing that hasn't changed is HP's corporate culture. The company continues to rely on promotion from within, bringing in few outsiders. Its management is still permeated with engineering experience and its turnover rates remain low. Minimal debt and few acquisitions are also venerable principles.

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Targeting the PC market

If HP is to meet its growth objective of 25%-30% per year, it must succeed in the high growth sectors of the personal computer market, which became a strategic area for HP about 18 months ago. Although HP did some $500 million worth of business in personal computers in 1982, it does not have a major presence in the commercial market. Its 68000-based 9800 series sales have been largely confined to the scientific/engineering world; the 125 has been sold primarily to HP's 3000 users, and its model 86 has had little retail impact. All three, however, have been successful niche products.

HP executives realize that if HP is to become a major player in the PC arena, it must develop a mass market image. Thus far, however, none of the company's products are really positioned to go head-to-head with IBM in commercial environments. Perhaps this is one reason HP has not committed to a major advertising campaign. If the game is to capture desks in the Fortune 1000, HP is not yet ready to make an all-out push.

On the other hand, the PC market has really just begun. In many ways, today's PCs are the 360s of the era. Apple won round one; IBM is taking round two; and there are many more battles to fight. IBM is setting the standards, but HP believes that it can differentiate itself from IBM by improving graphics, text, storage, display, packaging, communications, and software. HP has a reputation for quality and innovation among Fortune 1000 companies, and says its products will be among the three or four endorsed by most corporate buyers.

HP believes that by 1988, it must be prepared to offer a PC with 1MB memory, 1MIP speed, 50MB storage, and a letter-quality printer for about $4,000. It expects that it will tend to rely on outside microprocessors. Its own 32-bit chip is more expensive and sophisticated than the microprocessors available from Intel or Motorola. HP is also likely to go outside for small disks.

HP feels its internal resources are well suited to the PC market. It has proven strengths in easy-to-use graphics, and it has shown in its calculator business that it can make a profit building attractive single-user packages. The company believes that its shared resource manager concept puts it ahead of its major vendor rivals in terms of PC networking experience. Banging heads in the scientific market will help spur price/performance improvements.

HP also has strong internal semiconductor knowledge, particularly in NMOS and CMOS. It feels that CMOS will soon match NMOS price/performance, and it plans to have 300 NMOS VLSI engineers by 1985. HP is investing heavily in low-power CMOS technology and plans to add future portable products to join its handheld Model 40 and portable model 75. The portable computer market is a natural offshoot of HP's calculator and PC businesses.

By merging its peripheral and networking groups, HP showed it is committed to the resource sharing concept, and the company has some interesting peripherals including plotters and a laser printer. Since the key to building local networks is not the hardware connections but the software that makes them work, HP feels it is important to be able to integrate a full line of peripherals, and that such integration should be done by the hardware vendor.

EDP/IR agrees that local nets won't take off until major vendors such as IBM start aggressively pushing the concept with their own solutions. The

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problem for HP is that in most environments, the PCs will be bought first and then hooked together. Right now it looks like the PC will sell the network, not vice versa, and thus HP's PC success may have to await future products.

Integration strategies

Unlike its minicomputer competitors which tend to sell one family to both the scientific and commercial marketplaces, HP has developed distinct families for each market. Although this allows for more custom tailored operating systems, it adds extra development costs and makes compatibility of commercial and non-commercial products difficult. Currently, HP has large worldwide installed bases for both its commercial 3000 series (over 12,000) and its scientific 1000 series (over 50,000). Both families are now about a decade old, and thus have considerable entrenched software investment.

As IBM has learned with its multiple mid-range systems, compatibility problems become significant as networking demand increases. The more different operating systems that have to be dealt with, the more in-house expense, and the longer the lead times. HP realizes that in the long run a single operating system would be ideal, and hopes that Unix will fill that role.

But just as IBM is being forced to hammer out links between its small systems, HP will have to deal with its history. Unix may be the long term answer, but in the short run different operating systems will proliferate. On the hardware side, HP feels that merging the 1000 and 3000 development efforts is relatively simple, and the company is moving toward that goal.

Since networking in the scientific/engineering market is proceeding faster than in the commercial sector, parts of HP's networking strategy are already evident. In the engineering market, HP offers a variety of workstations -- the low-end 86, the 68000-based 9800s and the 32-bit 9000 series -- that can be linked via HP's Shared Resource Management Network.

The general theory is that applications processing is done at the workstation while the network provides peripheral sharing. Access to peripherals is controlled by a dedicated PC, which HP refers to as PC central. Specialized workstations, incremental expansion, and fast response are the key benefits. HP's approach resembles that of Apollo except that HP provides a lot of applications software, while Apollo relies on third parties. Unlike HP's, Apollo's systems were designed from the outset with networking in mind.

PCs such as the 9800s run both HP's design software and support "personal computing" functions such as word processing, spreadsheets, etc. In fact, HP says that engineers spend up to 80% of their time in non-engineering tasks, and thus they need general-purpose PC capabilities. To fill this role, HP has chosen Context MBA as its integrated PC package, and says it is very popular.

HP expects to transfer this networking approach to its commercial business. This implies that the company will come out with a PC that can run existing 3000 software as well as supporting personal computing tasks. HP executives agreed that such a product is likely. Honeywell pioneered this approach with its dual processor Micro 610, which runs CP/M, MS/DOS and Honeywell's GCOS.

Where does this approach leave the mini and the terminal? At HP the word "terminal" is practically extinct, having been replaced by the more modern

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"workstation." This exercise in semantics doesn't change the fact that HP builds 5,000-10,000 terminals per month, but HP believes that the terminal is on its way out, destined for specialized roles, such as portability.

HP also shuns the minicomputer label. Nevertheless, 3000 sales continue strong, and HP is pushing terminal-based systems as part of its thrust into office automation. Most of the success of HP's office systems has been as software add-ons to existing 3000 sites. Although 125s and intelligent WP devices can attach to the 3000, most users rely on dumb terminals.

HP, of course, does not think that the mini is dead. Although it sees the role of the mini changing, it agrees that the company will continue to need much more powerful versions of its 3000 line. The company sees the mini changing in much the same way as the role of the mainframe is being transformed.

In the future, the mini will be less concerned with running application software, especially in interactive environments. Rather it will serve as a keeper of the data base, and as a gateway to other systems in the network, including mainframes. HP believes that in large organizations 95% of the corporate data can be shared by multiple entities. Manipulating and distributing this data will require lots of processing resources.

As to networking technologies, HP believes that Ethernet-type links will be sufficient for most departmental needs, and PBXs will be the most efficient means to move data throughout an organization. HP sees its use of broadband primarily restricted to factory environments where applications such as process control or video-based security monitoring can take advantage of dedicated channels. For now, the main emphasis will be on small work area networks, and HP is working with Ungermann Bass' Ethernet LAN interface equipment.

Manufacturing market

HP's emphasis on applications software, networking, data bases and high value-added solutions coalesce in the company's bread and butter manufacturing market. To its credit, HP resists throwing around the "factory of the future" phrase, but believes that it has proven internally that integrated systems can lead to significant productivity gains, with reduced inventories being the main benefit. HP has tried to implement the Japanese "kanban" (just in time) system, and its Japanese joint venture has just won the Deming award.

There are basically three different approaches to the manufacturing market, all with significant overlap. Shop floor types such as Gould, General Electric and Westinghouse concentrate on working up from the tool level, while mainframers emphasize the advantages of a centralized data base. HP stands in the middle, trying to tie together its department level equipment via networking. It calls its approach the Manufacturing Productivity Network.

HP is concentrating on five key manufacturing areas: semiconductors; printed wire boards; electronics assembly; discrete mechanical; and process control. Although much of HP's manufacturing software comes from its own in-house automation efforts, it has made two acquisitions: Panacom (a Canadian process control software firm) and Software Management Corp. (chip specialists).

More than most vendors, HP makes a big effort to bring its in-house software to market. The company figures that this is only reasonable since at any

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given time there are usually six times as many employees working on in-house applications as there are on market-oriented application software. Much of HP's CAD software was originally used in-house, and HP's factory automation pitch includes a heavy emphasis on how things are done within HP.

There is, however, a recognition that the workings of the average factory defy packaged solutions and each customer must do a great deal of internal study to learn what type of automation will be useful. But once one gets beyond the shop floor into engineering, marketing, finance, personnel, MIS, quality control, etc., application needs become much more standardized.

Of chips and peripherals

One of the difficult questions facing any of the industry's large competitors is what should be built inside and what should be bought on the open market. Upgrades, deliverability, second sourcing, reliability, features, quality, and price are part of a complex decision process. Three key areas are semiconductors, storage devices, and printers.

In semiconductors, HP is concentrating on four basic technologies -- NMOS, CMOS, bipolar, and Gallium-Arsenide. The bipolar is necessary for the 3000 series and the GaAs used will be used first in some of HP's instrument products. HP claims its 512K ROM is still the industry's densest chip, although it has yet to appear in an HP product.

HP says that it is meeting about 50% of its IC needs internally, and that the share is rising over time. It claims that it is the fourth largest captive chip manufacturer behind IBM, AT&T, and GM's Delco. In terms of design, HP says that to keep up with its plans, it must by 1985 increase the productivity of circuit designers 10-30 times in terms of transistors per man hour.

Like IBM, Intel, and AT&T, HP chose not to join the Microelectronics and Computer Technology Corp. (MCC), expressing doubts over the degree of cooperation. HP president John Young remarked that MCC will bring out the real antitrust issue: "I don't trust you and you don't trust me." He added that the MCC was too much of a collection of the "have nots." HP would have been more receptive if IBM and Intel were committed to the project. HP is supporting the university-based Semiconductor Research Cooperative.

As for peripherals, HP expects them to beome increasingly important, from 46% of average system value in 1980 to 58% in 1985. Since peripheral development is expensive, HP is focusing on just a few areas in-house. In printers, its in-house work focuses on non-impact technologies, both line and page. In disks, HP will focus on the high performance areas of the market.

HP says that it will introduce disks with thin film media within the year, probably on the smaller drives since the yields are better. Unlike many of its competitors, HP does not feel that the 8" market is going to dry up and die. The existing software and proven reliability will keep it going. HP says that it probably knows more about removable media than anyone else, and its 400MB disk is the largest removable drive on the market.

As for printers, HP's big attraction is its 2680 laser which it says is proving more reliable than Xerox's 9700. HP got much of its laser technology from Canon. It expects to come out with lower speed and much cheaper versions.

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• IBM INTRODUCES NEW 8100; ENHANCES SERIES/1. Just when it was beginning to look like the 8100 was losing its luster, IBM came out with a low-end model, the 8130B, based on new VLSI technology which is 50% faster than the superseded 8130A. The use of dense FET and bipolar logic chips offers faster speeds, more main storage (up to 2MB) and larger logical addressing while suggesting that new larger 8100s are on the way. An improved version of the DPPX operating system and DOSF utilities are further evidence. In the literature accompanying the announcement, IBM refers to the 8100 as "IBM's primary host managed distributed data processing family."

Price cuts on other 8100 processors and peripherals ranged from 11% to 26%. An 8100B model 23 with 64MB of non-removable storage and 1MB memory costs $37,600. Deliveries are scheduled for February. In the same announcement, IBM introduced a physically smaller, more reliable version of the Series/1 that is priced 15% to 20% less. These announcements taken with May's showing of the System/36 and the expected introduction of small 370-compatible processors suggest that IBM will continue to have a wide variety of small processor solutions for some time to come.

• AFTERMATH OF AT&T SHAKE-UP. AT&T has vertically integrated its consumer goods R&D with manufacturing by taking R&D away from ABI and giving it to a group within Western Electric called American Bell Consumer Products Group. ABI keeps control of all marketing and its 451 phone stores. One popular explanation is that the moves will make it harder for ABI to sell non-Western Electric products, keeping WE's unions happy. The Net 1000 and the PBX and key set groups were essentially untouched by the turmoil.

• INTEL MOVES FOR 32-BIT MULTIBUS STANDARD. Intel has signed up twelve other companies to jointly develop specifications for a data bus for 8-, 16-, and 32-bit microprocessor systems. Called Multibus II, Intel hopes to set a standard that will last "at least a decade." It will be an upgrade path for current Multibus users, and will have many of the same features. Multibus is now used by more than 150 companies making over 1,000 products, and has become a standard -- IEEE 796. The thirteen companies involved are: Intel, Hewlett-Packard, Zilog, Advanced Micro Devices, Intersil Systems, Tektronix, ICL, Siemens, Matra, Nixdorf, Mupac, Compagnie des Machines Bull, and Dataindustrier.

• DEC SLASHES 11/730 PRICES. Citing reduced memory prices and the efficiencies of volume manufacturing, DEC reduced prices on its low-end 32-bit systems by from 17% to 30% for end user and OEM configurations. The moves are more likely an indication of competitive pressures than any forthcoming new systems. DEC has also been offering some substantial /780 discounts, although no formal announcement has yet been made.

• IBM DONATES $40 MILLION IN CAD/CAM TO SCHOOLS. Twenty universities will divide up the largest single grant in IBM history. Each school will receive a 4341-2, nine 3251 terminals; four 3279s; four 3101s; I/O gear and software from IBM and four independents -- Cadam Inc., Dassault Systems (France), Bell Northern Research Ltd. (Canada) and Structural Dynamics Research Corp.

• ARCHIE MCGILL JOINS TRILOGY BOARD; FRANK CARY RETIRES FROM IBM. A representative of Sperry will also soon join the Trilogy board.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet

DAVID MOSCHELLA, EDITOR JUNE 20, 1983 ● V/19, NO. 4 P.J. MCGOVERN, PUBLISHER

IBM buys 15% of Rolm -- Page 5

IBM UNVEILS FULL RELATIONAL DBMS; TIGHTLY COUPLED MVS/XA DESIGN SUGGESTS MORE PCM HEADACHES

IBM's Database 2 is being billed as the giant's solution to the application backlog problems that have plagued its IMS shops for years. After a decade of toying with relational technology, IBM has formally recognized end users' data base needs, and is offering a truly advanced product -- the first fully relational system from a major vendor to run on a large-scale processor.

From IBM's point of view, DB2 is a very important strategic product. Not only will its MVS/XA orientation put the chills into its hardware and software competition, but, if successful, DB2 could significantly add to IBM's sales of high-end CPUs, since it will probably demand a dedicated 308X processor.

Although there is little consensus on how much trouble DB2 and /XA will cause the DBMS and PCM vendors, this is certainly another dark cloud on the horizon. EDP/IR suspects IBM announced a product that it won't deliver for 15 months in order to stem the tide of users moving to non-IBM DBMS systems. As customers mull over /XA migration issues, many will think twice about buying a third-party DBMS or CPU until the dust settles a bit. Some points of note:

- MVS/XA impact. IBM strongly emphasizes that DB2 will run better in /XA environments than in S/370 mode. For users looking for incentives to migrate to /XA, DB2 performance may help.

- IMS links. DB2 and IMS will coexist, the former serving end users; the latter production tasks. IBM says it expects IMS to continue as its main production data base and will support it accordingly. IMS files can be extracted and loaded into DB2.

- SQL similarities. There is a strong similarity between the SQL/DS for 4300 and DB2. Both, along with Query By Example, are the offspring of IBM's System R relational system research.

- Pricing. The software price for DB2 and associated products -- about $4,100/mo plus $24,600 up front -- looks cheap compared to the competition and hardware resources needed for high-volume service.

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Overview of the data base management market

Perhaps it is no coincidence that IBM has unveiled an aggressive DBMS product. Research by International Data Corporation's Services and Software group reveals that 1982 was the first year that independent vendors brought in more DBMS revenues than their hardware manufacturing counterparts.

Application development under the 12-year old IMS is slow and the maintenance requirements have become unbearable for many users. This has enabled vendors such as Cullinet, Cincom, Software AG, Applied Data Research, and Computer Corporation of America to enjoy relatively rapid growth. CCA's Model 204 and ADR's Datacom/DB/DC have been selling particularly well of late.

Although the total worldwide mainframe DBMS market, was worth just $312 million in 1982 this is a very influential sector. IDC expects revenues to grow at 22.9% through 1987, reaching $876 million. But much more importantly, good end user tools will become the key to maintaining mainframe hardware sales.

IBM's information centers have been catching on, and they have already proven that a successful information center using a non-procedural language, such as Ramis, Focus, Intellect or the like, will require a powerful CPU. Although IBM's software revenues are growing fast and becoming more substantial, they still represent less than 5% of company revenues. For at least the next few years, hardware will remain the name of the game. In fact, surprisingly, IBM's DB2 software prices ($50,000 per year) look reasonable compared to competitors' DBMS packages which usually run in the $190,000 to $300,000 range.

Up until now IBM has been relatively easy on the independent DBMS vendors because they have kept users happy and probably created at least as much business as they have taken away. But IBM appears to have concluded that the independents' meddling with IBM operating systems is now causing more harm than good. If this is the case, IBM can be expected to treat the DBMS vendors like its PCM hardware competitors, as thorns best gotten rid of.

IBM's restrictions on source code dissemination are part of this picture. There are some who feel that if IBM had its druthers, it would put its operating and utility systems into a black box, and allow others to deal with it only at the applications level interface. By preserving MVS integrity, migration to new releases would be much smoother, and the independents would be forced to focus on applications, the argument goes.

But because IBM users often feel that custom modifications are necessary for performance and because there are so many programmers who know how IBM source code works, this extreme case is unlikely. Nevertheless, Cullinet's movement into the microcomputer and applications business, and Cincom and Software AG's play for DBMS on non-IBM hardware suggests that the dangers of swimming in IBM's waters are now recognized.

With the proliferation of personal computers, IBM is now preparing for an exponential increase in end user demand over the next few years and beyond. Concomitant with this demand will be a sharp increase in the mainframe's role as a provider of data as production application growth levels off. Relational-like inquiries and manipulations will be essential to prevent massive backlogs. The third quarter 1984 delivery of DB2 comes none too soon, but since much DB2 testing remains to be done, rapid implementation is by no means certain.

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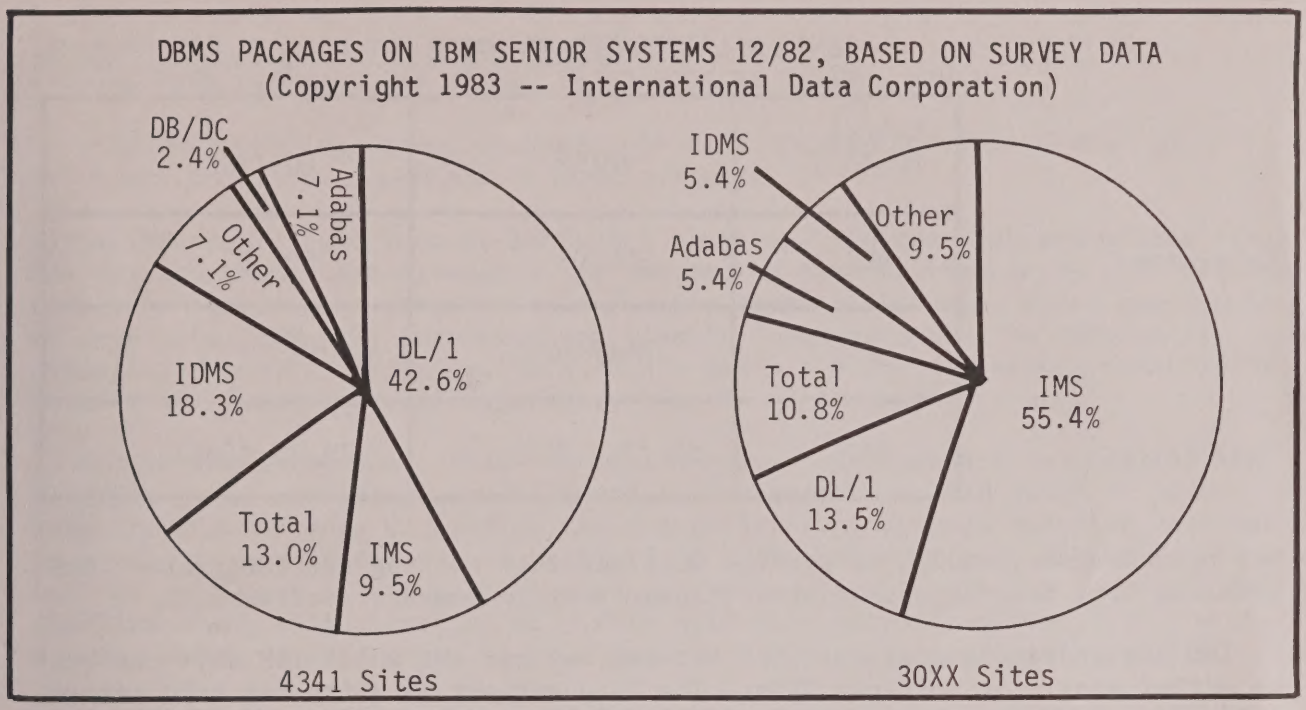

Inside DB2 -- features and facets

In its technical literature IBM clearly lays out what it sees as the key benefits of DB2. They are basically the same as those promised by vendors of DBMS packages or fourth generation languages. They include: ease of use; faster application development; personalized data bases; decision support systems; ad hoc inquiries; complex searches; "what if" tasks and short term data bases that wouldn't otherwise warrant development.

Besides offering these new capabilities, DB2 is the first product that will separate the /XA "haves" from the "have nots." Although DB2 will run under 24-bit /370 programs on 30XX CPUs, IBM has said that "DB2 is designed to utilize the /XA architecture" and that it intends to "provide improved DB2 utilization of 308X class processors through the facilities of MVS/XA." At this time there are no new microcode assists. This should make life easier for PCM hardware and software vendors, although future microcode implementations seem likely.

As for performance, IBM says that comparing applications running on IMS and DB2 is an "apples and oranges" type of thing. It does add that DB2 will consume "much more resources than IMS." This is hardly surprising given the power-hungry history of DBMS software and fourth generation languages. Since DB2 has only been beta tested under TSO in MIS-type environments, even IBM probably isn't sure what actual performance will be. IMS/DC and CICS testing won't begin until December.

Although DB2 can operate as a standalone product, it will in most cases be sold into an IMS shop. Over 80% of the 308X machines installed to date employ some type of DBMS, with IMS holding by far the largest share (see charts.)

The much talked about two DBMS shop will thus become more of a reality than is currently the case. Most of the independents are aiming toward a single, integrated data base, offering "relational-like" views of hierarchical or network structures. This has the advantage of building off existing files, but seems to have prevented true relational implementations. This limitation

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IBM'S RELATIONAL DATA BASES

	MVS/XA MVS/370	VM/SP	DOS/VSE
Data base	DB2	SQL/DS	SQL/DS
Query	QMF	QMF/SQL	SQL/DS (ISQL)
Data Extract	DXT	SQL/DS (DBS)	SQL/DS (DBS)

was not, however, enough to prevent Cullinet from calling its integrated IDMS offering "the most important breakthrough ever in computer software."

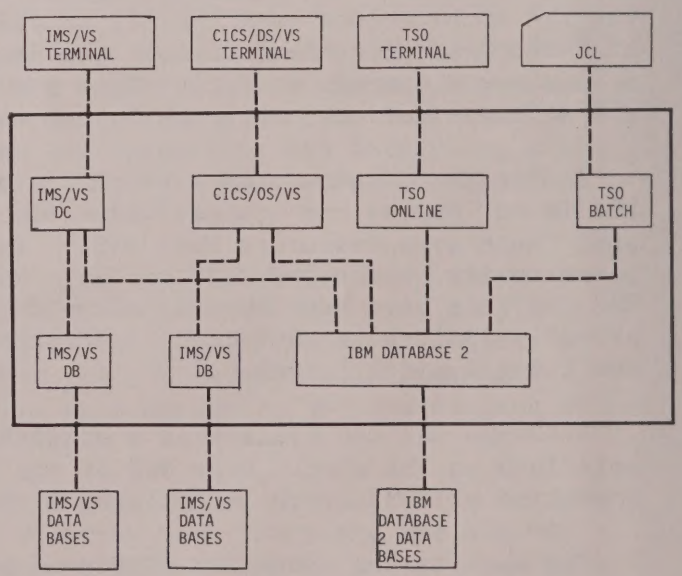
IBM has chosen to provide links between DB2 and IMS which IBM says can run on either single or multiple CPUs. The data extract facility can take information from IMS data bases and VSAM and SAM data sets and load them into either DB2 or SQL/DS. If the data resides on a different processor it can be sent via JES/2 or JES/3 networking facilities.

EDP/IR believes that, as is the case with SQL, most relational files will be built by the end users, who will essentially have their own data base. Although this raises issues of concurrency and redundancy, performance concerns and ease of use suggest that frequent entry into IMS might not be desirable.

In time, as DB2 files expand and as redundancy increases, some users may feel that IMS is no longer necessary. But as long as IMS can significantly outperform DB2 in production tasks it should have a useful life, and no relational system on the market today can match a hierarchical or network system's efficiency. An eventual merging of the two, although logical, will probably be some time in coming.

The actual DB2 data structures and manipulations are similar to SQL/DS. IBM says that the SQL on its DOS and VM systems is "broadly compatible" with DB2's SQL. Although this suggests that eventually IBM's DOS or VM/CMS machines may be able to access DB2 files, right now "most data" can only be moved upward from the smaller CPUs to DB2. Since the SQL interface was too complicated for the average non-DP user, IBM offers a new Query Management Facility for DB2 and SQL.

DB2 AND IMS UNDER MVS



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IBM BUYS 15% OF ROLM FOR $228 MILLION;
VENDORS PICK SIDES AS PBX MARKET GAINS STATURE IN THE OFFICE

"Zaibatsu -- (the money clique), the great family controlled banking and industrial combines of modern Japan."

Maybe IBM should give lessons in family planning. In the eighteen months since the antitrust suit was dismissed, it has proven that it can choose its children wisely. Although the term "zaibatsu" may overstate the case, there can now be no doubt that IBM will form whatever ties it deems necessary to improve its competitive position. Intel, Rolm, who's next: a 5.25" winchester maker? a terrestrial voice carrier? a software house? a distributor? a bank?

Unlike the Intel deal, this one will involve joint product development and possible joint marketing, and is further indication that IBM knows it cannot cede the PBX business to AT&T or the independents. Although American Bell has been slow to get products to market, if it ultimately controls PBX usage, it will be much more of a threat to dictate the terminals, personal computers and the like which will attach to it. PBXs will also serve as gateways to the outside world, a role probably more important than policing local traffic.

In terms of the PBX market, the IBM move is part of an ongoing reshuffling of the players. As PBXs become expected to carry data, vendors are choosing sides. At the same time, new players (Ztel) and technology (Intecom) continue to enter the market, while others (Datapoint and Rockwell) have seen the window close and dropped out. IBM is now reassessing its technical relation with Mitel, whose SX-2000 PBX has been delayed.

For a market, which IDC expects to grow at just 7.3% per year, from $1.18 billion of U.S. shipments in 1982 to $1.68 billion in 1987, PBXs, especially digital PBXs, are sure attracting a lot of attention. Some of the key factors:

- Alignments. Other than the financial stake, the IBM/Rolm deal resembles many others announced this year. Rolm is cooperating with DEC, DG, and HP, while Northern Telecom is working with Sperry, HP, and DG. NCR has bought into Ztel; Honeywell has its Action subsidiary. An off-beat link is that between Arco and Anaconda Ericsson.

- Competition. The introduction of AT&T's S/85 hasn't stopped the steady erosion of AT&T's market share.

- PBX vs. LAN battle. The hoopla comes down to cost and desired bandwidth. PBXs can handle slow speeds cheaply; LANs offer high speeds at a price. The two markets overlap in the area of 64kbs traffic.

- International markets. Although there has been a lot of hype over ITT's PBX sales to NTT, the Japanese market will be tough to crack. But other nations look promising, and joint ventures are in vogue.

- Technology. Intecom is challenging the assumption that a PBX cannot support high bandwidth, claiming a virtual 10Mbps link.

- Traffic. PBXs can handle terminal traffic, and little CPU-to-CPU transfers are being done; but high bandwidth demand will come soon from text, resource sharing, and bit-mapped graphic displays.

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The IBM/Rolm link

IBM is certainly not bashful about buying at premium prices. Paying $228 million for 15% of Rolm implies a market valuation of $1.5 billion. This for a company whose fiscal 1982 (ending July 1982) revenues were only $381 million. (Estimates of fiscal 1983 revenues are in the $500 million range.) In contrast, IBM paid $250 million for 12% of Intel whose 1982 revenues were $900 million. In both cases, IBM has agreed to limit its share to a maximum of 30%.

IBM bought into Rolm at a time when its shares were a relatively expensive $59, having been less than $20 within the last 12 months. After the news hit Wall Street, Rolm stock went up another $13, giving IBM a nice paper profit. Intel stock has also risen considerably since the IBM purchase.

Unlike the Intel situation, Rolm was not in need of cash. It has lots of liquid assets and little long term debt. The $228 million injection is almost ten times Rolm's fiscal 1982 spending on product development, and thus one can expect considerable increases in R&D, most likely with IBM in mind.

Over the last year Rolm has introduced a voice messaging system on its CBX series. (Rolm uses the term CBX, computer branch exchange, instead of the more common PBX label.) IBM also has a message system, but it makes more sense to integrate a voice store-and-forward system with a PBX than to sell it as an add-on. Such voice systems are an alternative to electronic mail offerings.

In March, Rolm announced gateways to IBM 3270 applications, OEMed from Datastream. Through the PBX, users of ascii terminals, PCs, or word processors can get into 3270 applications. The Rolm CBX emulates a 3270 cluster controller, offering access to shared modems and printers. The IBM PC connection is a direct plug-in to the PC's I/O slot, replacing and emulating the IBM asynch card.

Certainly the IBM/Rolm connection will be useful when executive workstations start getting coupled with telephones. Rolm and other PBX vendors have been dabbling in this area for a couple of years, but the products still haven't found a spot in the market, and are probably at least a few years out.

In addition to possible voice offerings and terminal-type links, IBM and Rolm might well engage in joint marketing, if not in the U.S. then certainly abroad. Rolm is eager to penetrate international markets, and IBM might prefer to sell Rolm's CBX than the obsolete PBX it has tried to push in Europe.

Rolm claims that it has at least one PBX installed with every member of the Fortune 20 and with 80 out of the top 100. As of July 1982, it had some 9000 systems installed in 25 countries. As of April of 1983 it had installed 150 of its integrated voice/data systems, and claims to be the voice/data market leader with 7,500 "data connections" as of April.

Key issues in the PBX vs. local area network debate

In January, AT&T with its Dimesion 85 finally endorsed the concept of using a digital PBX to switch data, further fueling the long running debate as to what the backbone of the electronic office should be. EDP/IR believes that there will be many different communications solutions, depending upon size and user traffic patterns. Baseband, broadband, and PBX solutions all have particular strengths and weaknesses.

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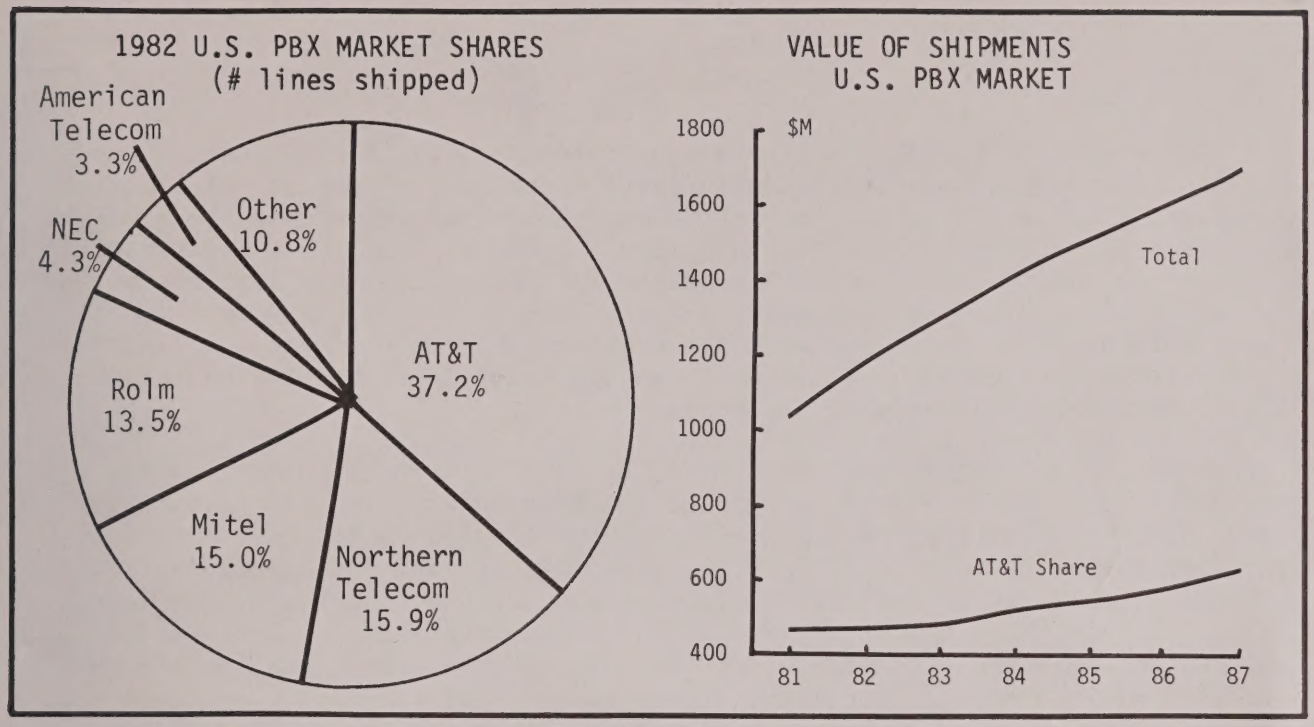

Much of PBX vs. LAN debate will center around costs. It is generally true that once the PBX is in place, costs to upgrade a PBX for data or to build a LAN can be similar, somewhere around $500 to $1,500 per connection, depending upon supplier, speeds, number of nodes, and network medium.

Network expansion is another key area. LANs have the advantage of being much more incrementally expandable than PBXs, which have to assume some type of future device population and run the risk of being unable to handle faster than expected growth. On the other hand, once a PBX network is set up, new nodes can be added wherever there is a telephone, something a LAN couldn't do unless it served the whole office.

EDP/IR sees a fragmented market. Baseband products such as Ethernet or Mirlan (recently announced by Intel and NCR) will be cost-effective in small, department-level systems. PBXs will be good at linking isolated terminals to remote or local hosts, or handling bursty traffic such as electronic mail, but probably will not be installed in high traffic environments. Office-wide broadband networks will be there for users who need, or expect to need, high bandwidth across a large population. PBXs will have to carry at least some data because they will be a key link to the outside world.

If current usage patterns persisted, PBXs might be more efficient than LANs. Most of today's data traffic is interactive, short session with data bases. CPU-to-CPU links are a very small part of the traffic mix. In typical on-line processing applications, performance limitiations stem from the CPUs ability to handle terminal sessions not from any bandwidth limitations.

But this environment is changing rapidly. Mainframe-to-micro links, large document distribution applications, shared printers and disks, and the retrieval of images for bit mapped display will all require very high bandwidth measured in megabits/sec. It is unlikely that this type of demand can be met by PBXs. Where personal computers are installed in large numbers, the market for LANs looks good. Terminals still look like the realm of the PBX.

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• SPERRY BUYS INTO TRILOGY. Maybe this time Gene Amdahl won't have to go to the Japanese to finance his vision. Sperry has agreed to pay $42 million for a 15% share of the PCM start-up. Although the move suggests that Sperry might someday enter the IBM-compatible business, Sperry is more likely interested in Trilogy's plans for wafer-scale integrated circuits. Over the last few months Trilogy has taken some of the wraps off its technology and the project now looks more exciting than ever with first shipments scheduled for the first half of 1985. Honeywell and CII-Bull had previously invested in Trilogy. More outside funding may still be necessary.

• AMDAHL, WANG, SPERRY WIN BIG CONTRACTS. In the largest contract ever awarded in Australia, Amdahl, Wang, and STC beat out IBM in winning parts of a $100 million dollar plan to upgrade that country's social security system. for Amdahl the contract is said to be worth $24 million, and Wang is expected to install some 100 VS systems. In a contract worth $433 million over five years, the U.S. Navy has picked Sperry for a new generation of large-scale ship-board computers. Two months earlier the Navy gave Sperry a similar deal for $500 million and the Air Force signed for $476 million.

• MCGILL RESIGNS FROM AT&T. Just one day after AT&T took responsibility for its consumer products away from American Bell and gave them to Western Electric, ABI president Archie McGill resigned. Such a major restructuring of ABI just six months after it was founded certainly raises questions about the cohesiveness of AT&T's strategy, and placing a fast moving sector such as consumer products into the monopolistic mindset of Western Electric seems puzzling. As for McGill, he left IBM 10 years ago to prepare Ma Bell for the information age, and more than any other he is responsible for what ABI is today. The one-time wunderkind -- an IBM VP at age 33 -- has already signed on to be president and chief executive officer of Rothschild's venture capital group.

• IBM CUTS MEMORY, MAINTENANCE PRICES. Perhaps as a move to entice users to add more memory, IBM cut 30XX memory prices 20% to $20,000 per megabyte. It also reduced 308X maintenance rates by about 15%. Since IBM has no real competition in either of these areas, its motives are not clear. IBM charges just $10,000 per MB on its small systems, and maybe this difference was getting a little hard to explain. IBM also cut the purchase price on 3350 drives by about 23% in an attempt to convert users from lease to purchase.

• NCR ENTERS TELECOMMUNICATIONS BUSINESS. At the International Communications Association conference in Anaheim, four services were announced: a long-distance telephone service; a point-to-point data/voice transmission service; a telephone accounting system; and a dedicated voice/data network between specific cities. Honeywell's Action group is NCR's key supplier.

• SPERRY ROLLS OUT 1100/70 SERIES. Effectively replacing the 1100/60 series the 1100/70 series offers up to 8MB per CPU and offers a multiprocessing option unavailable of the 1100/60s. The price of the entry level 1100/71 with 0.5MB memory, system and communications processors, mass storage processors, two 125MB disks, two tape drives, and a line printer is $395,297, or $10,504 per month on a five year lease. The systems are available now.

• IBIS DELAYS 3380 SHIPMENTS. Volume shipments are now set for the fall.

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"The Gray Sheet"

DAVID MOSCHELLA, EDITOR MAY 19, 1983 ● V/19, NO. 3 P.J. MCGOVERN, PUBLISHER

IBM S/36, NCC round-up -- Page 5

PORTABLE COMPUTER MARKET READY FOR TAKEOFF, BUT TECHNOLOGICAL, MARKETING ISSUES REMAIN UNSETTLED

The portable computer market makes the fierce competition in the desktop computer arena look staid, mature, and even a little predictable. Whereas the desktop battle is dominated by four main issues -- distribution, software, name recognition and price -- the market for portable computers is highly fragmented, involving shifting technologies and complex trade-offs between displays, storage, weight, etc. The dust won't settle until major vendors make their play.

Thus far the market has been dominated by transportable versions of today's desktop technology, but EDP/IR believes that specialized niches -- word processing, engineering, data collection -- are on the rise. Vendors expect that IBM and Apple will follow Commodore in staking out its software base, and many are now looking to the periphery to maintain margins and preserve product identity.

International Data Corporation, publisher of EDP/IR, has counted some 43 suppliers of portable equipment, and the stream of entrants shows no sign of drying up. At stake is a 1983 market of over $2 billion. Some key issues:

- Applications. Although applications such as spreadsheets and word processing are important, portables will help open up new areas such as electronic mail, data collection, and field engineering tasks.

- Displays. The principle complaint against portables is their small displays, but screen technology is advancing rapidly and 24-line LCD capabilities should be available within the next 18 months.

- Prices. Expect prices to fall sharply once volume supplies hit the market. The low-end may even see a repeat of the calculator wars.

- Storage. Microfloppies, microwinchesters, bubbles, ROMs, and cartridge tapes all have pros and cons. Currently, 5.25" floppies are dominant but this is changing very quickly.

- Bundled software. For marketing and packaging reasons, bundled software is proving popular for mainstream applications.

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Segmenting the portable computer market

With products that span the range from handheld devices to 30 pound boxes the size of sewing machines, there is some confusion over what is and what isn't a portable computer. IDC requires that portable computers have a full keyboard, data storage capability, ability to display at least one line of text, and an operating system with high-level language capability. IDC breaks the market into four divisions:

- Handheld
- True portable
- Plug-in portable
- Transportable

Although there are some fuzzy border lines, the distinction between portable and transportable generally comes down to weight and power supply. A portable computer should weigh less than 15 pounds and have battery power. Transportables are designed for A/C power. Plug-in portables include those systems that either need an outside power source or rely on an external display, i.e., a TV set. The chart below shows some typical products in each category.

PORTABLE COMPUTERS BY PRICE AND IDC SIZE CATEGORY

PRICE RANGE	HAND-HELD COMPUTERS	TRUE PORTABLE COMPUTERS	PLUG-IN PORTABLE COMPUTERS	TRANSPORTABLE COMPUTERS
$7,000		GRID SYSTEMS "Compass"		MICRO APL "Scorpion" Digital MicroSystems "DMS-15"
$5,000		GAVILAN COMPUTER "The Gavilan" ATHENA COMPUTER "The Athena"	OTRONA "Attache"	JONOS "Escort" COMPUTER DEVICES "DOT" MICROSOURCE "Voyager" HIGH TECHNOLOGY "Mayflower" DYNALOGIC INFO. "Hyperion"
$3,000		TELERAM "T3000" DVM MICROELECTRONIC "Husky" EXIDYNE "Electronic Book" SHARP "PC-5000"	SORD "Socius STM ELECTRONICS "Pied Piper I"	COMPAQ "The Compaq" CDS - "Corona "Portable" COMPUTER SHOP "Starlite" TELCON IND. "Zorba" "Nomis" OSBORNE "O-I" "Executive/E" NON LINEAR SYS. "Kaypro" SEEQUA "Chameleon"
$1,000	HEWLETT-PACKARD "HP-75" TEXAS INSTRUMENTS PANASONIC "The Link"	EPSON "HX-20" TANDY-RADIO SHACK NEC "PC/2000"	UNIVERSAL RESEARCH "Portabrain" TIMEX/SINCLAIR	COMMODORE "Executive 64"

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1983 WORLDWIDE PORTABLE COMPUTER SHIPMENTS, UNITS AND VALUE*
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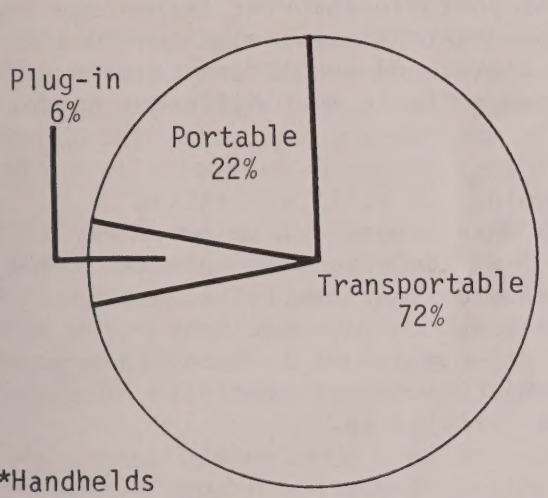
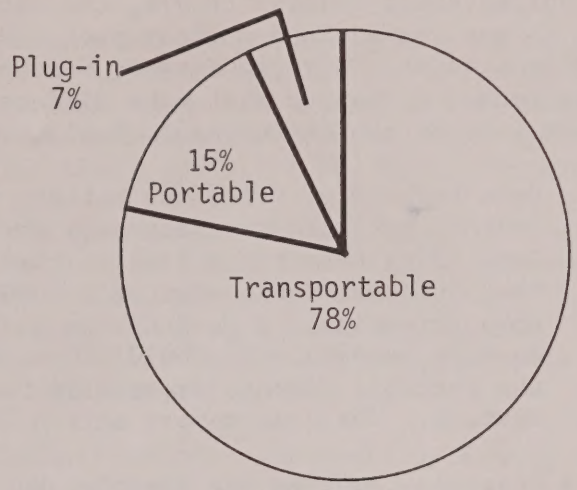


890,000 Units



$2.1 Billion

*Handhelds excluded

The data shows that for 1983 transportable computers will dominate in terms of both units and value. EDP/IR feels that this is much more a factor of product availability than an expression of buyer preference. Consequently, as technology advances and the supply of truly portable computers increases, the market will steadily shift toward the smaller units. Nevertheless, transportable machines will take the bulk of the dollar value at least through 1984.

IDC sees the portable market grabbing about 20% of the overall personal computer market over the 1983-86 period. But to clarify the relation between portable and desktop computers, many issues will have to be resolved. Among them:

- Compatibility. IBM, Apple and HP are likely to come out with portable versions of their PCs, but how many others will follow?

- Buyer preference. Do users want two machines, i.e., a desktop and a portable, or just a transportable? Will most desktops ultimately be transportable? Users may prefer a transportable over a desktop so they can learn how to use it in the privacy of their own home.

- New markets. How many new applications -- electronic mail, data collection/communication, field service, etc., will portables create?

The vendors in today's portable market realize that the giants of the desktop market will have an edge in the mainstream portable business. Thus, many new suppliers are offering more than just the CP/M offered by Osborne, Kaypro, and Access Matrix, or MS/DOS from Compaq, Corona, and Computer Devices.

Epson is going for low prices and word processing, as is Tandy with its 800. Grid has staked out the high-end "Gucci" market. Gavilan expects to do a lot of work with OEMs and private label accounts. HP will focus on engineering and instrumentation tasks as well as compatibility with its larger systems. HP also has plans to enter the route accounting -- service, delivery, measurements, etc. -- business, believing it may eventually prove to be bigger than the market for professionals. Today's portable data collection market, led by MSI, seems to suggest otherwise.

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Technological issues

Unlike their desktop rivals, the future of portable computer technology has yet to get locked into a clear path. Whereas desktops are moving toward industry standard microprocessors, Winchester disks, and sophisticated user interfaces, portables must make different trade-offs to meet different needs. Among some of the key technological issues:

- Cmos technology. Because battery technology is still a limiting factor, portable manufacturers are much more interested in low-power Cmos chips than their desktop rivals. One side effect of this is that National Semiconductor's 16000 microprocessor family is getting more attention. A good design that was just too late for many desktop vendors, the 16000's Cmos strength could come in handy in the portable market, especially for sophisticated engineering devices. The Cmos memory action is also picking up.

- Storage. Bubbles are durable, but use a lot of power and have a high per/bit cost. Disk drives are bulky and may not stand up to the rigors of travel. Tape is too slow. Depending on the system, i.e. book-size vs. transportable, storage technology will vary. Grid and Sharp are using bubbles, Gavilan an Hitachi 3" microfloppy. Most transportables are using 5.25" floppies. Programs stored in ROM or bubbles are also becoming popular.

- Displays. Most of today's displays are either 8 lines by 40 characters or 4 lines by 60-80 characters. Transportable vendors are using mini CRTs, while most portables are using LCD (liquid crystal display). Grid uses an electroluminescent panel made by Sharp. The battle is clearly between LCD and electroluminescence/plasma. The former uses less power, the latter is more capable and, according to Gavilan, will cost less. Display research remains a very hot area.

Software concerns

If portable computers are really going to tap the mass market, they will have to be even more "user friendly" than desktops. Any necessary manuals should be similar to those which come with pocket calculators. Interestingly, some significant software work has already been done in the portable area -- particularly by Grid and Gavilan. Software bundling is a key issue.

Software bundling can occur in one of two ways: the price of the software can be included with the system price, or the software can actually be resident in the hardware. Transportables such as KayPro and Osborne fit the former, while portables such as Grid, Gavilan, and Sharp meet both criteria. (Sharp's software has yet to be introduced, but it says that a major software house is working on it.) At the low end, specialized, book-size devices such as those made by Tandy and Epson strive for a few easy-to-use, built-in applications such as word processing and data entry, again meeting both criteria.

Bundled software pricing helps make the machine's advertised list price at least resemble what users finally pay. Software stored in ROM or in bubble can increase ease of operation since the user does not have to be constantly loading and unloading software. Most transportable machines require lots of diskette swapping just like today's desktops.

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IBM SYSTEM/36 SHOULD PROTECT SYSTEM/34 BASE, MAY BE IBM'S BEST DATA/TEXT SYSTEM

Those who thought that IBM's grand reorganization of 1981 would lead to rapid homogenization of its product line will have to think again. IBM's System/36, billed as the first of a new family, guarantees that much of IBM's S/34 base will continue to operate outside of both the S/38 and 370 worlds, although certain similarities suggest that an eventual link to the /38 may be in the works.

As a /34 upgrade, the machine looks like a winner. If nothing else it will make life more difficult for S/34 poachers such as Wang, Sperry, and Honeywell. In addition to 30% more power, more workstations, and more storage, the /36 offers menu-driven text and graphics facilities along with links to the IBM PC. These hybrid capabilities suggest that the /36 may well reach new customers in large and small organizations. Specific highlights include:

- Compatibility with the /34. IBM claims that after recompiling almost all of the 1,500 third party applications and over 150 IBM applications for the /34 will run on the /36. IBM says early conversions have been very easy, some being finished in less than 24 hours. The only problems have been with some third party programs written in Assembler. Just about all peripherals on the /34 will run on the /36. The new big (400MB) disks are the same as on the Series/1.

- Compatibility with the /38. IBM says the conversion from /36 to /38 will be similar to that from the /34 to the /38. On the other hand, the /36 has compilers, menus, and user interfaces that are similar to the /38, and the /36's "Alternate Index" facility is "relational like." IBM insists, however, that the /36 architecture is much more akin to the /34 than it is to the /38's data base orientation.

- Architecture. Like the /34, the /36 uses multiple (up to 7) IBM-developed microprocessors to handle specific tasks. A new operating system is described as an enhancement of the S/34's SSP. All applications are menu-driven with over 2,000 "help" screens.

- Office features. Text processing, document distribution, spelling checkers, and directories are available (one-time license $3,450). The WP interface resembles that on the Displaywriter. The new 5292 graphics terminal offers a bit-mapped display which can connect to the IBM XY 749 color plotter built by IBM Instruments.

- Reliability. At its press conference at NCC, IBM billed the /36 as "the most reliable system IBM has ever built, and maintenance fees are 40%-50% less than on the /34. The/36 has been beta tested at 25 sites since this past January.

- Price and availability. Volume shipments begin in July out of IBM's Rochester facility. Prices are slightly less than the /34 for similar configurations with about 30% more power. A basic system with 128K memory, 30MB disk, two displays, a printer and operating system costs $34,000. A /36 with 512K, 400MB disk, 26 displays, 3 printers, a tape drive, operating system, languages, and utilities goes for $176,000. The /34 is now in limited new production and its prices were cut by an average of 20% in Europe, but no change in the U.S.

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1982 U.S. SHIPMENTS, IBM MID-RANGE PROCESSORS, UNITS AND REVENUES
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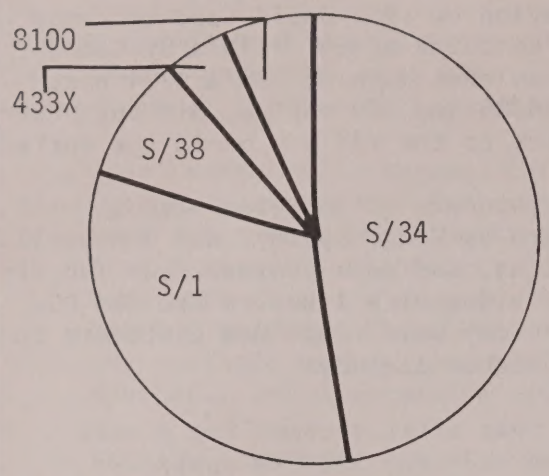
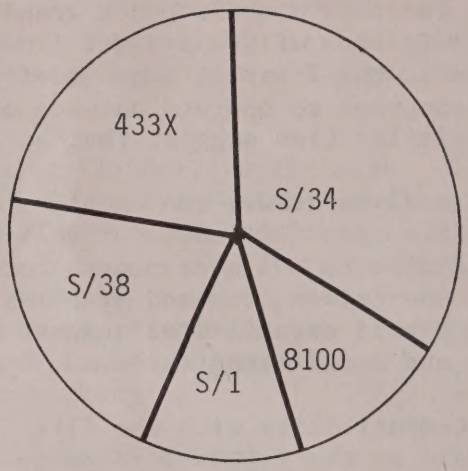


27,300 Units



$2.3 Billion

Caveats. The above data is based on IDC's preliminary 1982 shipment estimates. The dollar figures are based on average system values, not all of which -- especially for the 4300 and the S/1 -- would accrue to IBM.

IDC estimates that as of the end of 1982 there were some 92,000 S/34s installed worldwide. Despite the fact that the system is now more than five years old, shipment activity has remained substantial, as shown in the chart above. Given that the /38 was never really the right upgrade product for many /34 users, EDP/IR expects that the /36 will be a very successful product. IBM proudly says that the /36 has the best ease-of-use, price/performance, and reliability of any product in its class.

Although there is clearly a significant price overlap between /36 and the low end of the /38 family, IBM does not see this as a problem. It says that the machines are very different. If one wants a faster version of the /34 with new features, buy the /36. If the customer prefers a data base driven environment, then the /38 is the solution. IBM adds that the movement from a non-relational to a relational system will necessarily involve some complex conversion issues, regardless of the manufacturer.

Since IBM has yet to develop an attractive office/data system for its 370 mainframe base, the /36 may take on further significance. Many 8100 or 4321/31 users probably wish they could get some of the /36's ease-of-use features, but IBM does not want to see the 370 customer base move in the /36 direction. However, unless IBM announces similar capabilities for its mainstream customers, the /34, /36, /38 base of support will continue to grow stronger. The fact that IBM continues to develop more powerful versions of the /38 indicates that large users -- such as General Motors -- prefer the /38 for certain tasks.

Although life might be easier if IBM only had to support one integrated product family, many users prefer the old General Systems Division products, and the revenue base is much too big to ignore. Thus, the product line confusion will persist for the foreseeable future. One bright side for IBM is that the /36, /38 business is unlikely to be targeted by the PCMs, especially the /38.

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WESTERN ELECTRIC, CDC, NCR JOIN IBM IN MAKING MAJOR ANNOUNCEMENTS AT NCC

After a 1982 show dominated by desktops, the National Computer Conference saw a return to its roots, with major announcements by industry stalwarts such as IBM, CDC, NCR, and Western Electric. Were it not for the insufferable heat in the tents, this year's NCC would have been one of the smoothest in memory.

The joint press announcement by Western Electric, Intel, Motorola, and National Semiconductor takes the award for strange bedfellows, especially given Western's entrance into the merchant semi business. Four rivals standing on the same podium talking about agreed-upon standards? A rare sight indeed.

The focus of the hullaballoo was Western's Unix System V. The three semiconductor vendors have signed a letter of intent to develop a terminal independent standard interface to System V so that, theoretically, Unix applications will become truly portable. The microprocessors involved are Intel's 286, Motorola's 68000, and National's 16032. Although Zilog and TI seem temporarily out in the cold, Western says it is willing to work with other vendors. The move comes none too soon as Unix variants have been springing up all over the place (Xenix, Genix, System 3, etc.) although Intel says it will continue to work with Microsoft on both Xenix and Unix System V.

Despite many doubts about the appropriateness of Unix for many microprocessor-based systems, the market is moving ahead. A spokesman for Motorola estimated that there were about 45 Unix products at NCC. In theory, if Unix System V catches on, and if applications become truly portable, then the competition in the semiconductor industry will shift back to the delivery of high price/performance silicon, instead of software compatibility. This is perhaps the only way that Intel's and Motorola's lock on the 16-bit market can be broken. But Unix success will probably lag as long as IBM continues to ignore it.

CDC shows new disk line-up

This year's NCC provided strong evidence that the days of the dual floppy drive desktop are surely numbered. The floor was almost littered with low-cost 5" and 3" Winchesters with OEM prices plunging into the $400 range.

As the market shifts toward smaller drives, CDC, which has dominated the minicomputer 14" disk market, has had to react quickly. Given the large number of suppliers in the 5.25" market, high market shares will be hard to come by, but CDC at least has a full range of products ready to go.

At NCC, CDC's OEM peripheral group unveiled seven new drives -- a 3.5" thin film head, plated media 6.4MB Winchester called the "cricket"; two half-height 5.25" floppies; an 80MB version of its 5.25" Wren Winchester; two 9" fixed disk drives; and an 825 MB 14" Winchester that uses CDC's thin-film 3380 technology. CDC claims "the broadest most technologically advanced product line in the industry," adding that its joint venture peripheral strategy will in 1983 give it access to over $100 million worth of disk and tape technology investments.

As a broad-based OEM supplier, the success of CDC peripherals is tied to the economy. CDC says it is "cautiously optimistic" and is adding some workers. It expects high growth rates to return in 1984, noting that it expects to be the "leading (peripheral) supplier in the personal computer business."

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NCR rolls out new mainframe options

As expected, NCR has chosen to take a building-block approach to its large systems. The new 8600 line-up doesn't really introduce any new hardware; the processing units are the same as in the superseded 8650 and 8670. What is new are the software and hardware that allow up to seven different combinations of tightly and loosely coupled processors to be linked along a high-speed bus. NCR believes that this blend is useful since tightly coupled processors are geared to high-performance, and loosely coupled toward high availability. NCR says performance spans the range from the IBM 4341-11 up through the IBM 3083J.

The new systems are billed as "high availability" as opposed to fault tolerant. NCR has put its software efforts into areas such as load leveling and dynamic channels, in what it calls "one of the most advanced I/O systems in the industry." EDP/IR believes that load-leveling and modular expansion are at least as important to transaction processing customers as total redundancy.

Base price for the single processor 8635 (competing with the 4341-11) is $495,000 and includes 4MB memory, 32KB cache, 16 channels, console, and system control unit. The new machines are compatible with NCR's VRX operating system. Deliveries begin in the fourth quarter of 1983.

Gould shows new gear, latest Convergent Workstation

Gould is relying heavily on Convergent Technologies in its bid to gain a share of the manufacturing systems market. A few weeks ago, it announced that it would use Convergent's Megaframe supermini (which Gould calls the PS 3000), and at NCC the Gould booth featured Convergent's as yet unannounced next generation of workstations, code named N-Gen, which Gould has labeled the PS 1000.

The new workstation is still based on the Intel 8086, although Gould says it will move to the 186 soon. There is a new, flat keyboard and the processing and storage modules are very different, looking like a line of books that expand modularly as storage needs dictate. But the key difference is that CP/M, MS/DOS, and Xenix will be available; previously, Convergent's workstations were CTOS only. Additionally, the power supply can be located remotely to eliminate fan noise. Gould says it plans to ship the PS1000 by October, meaning some type of Convergent announcement will probably be made before then. As further evidence of its interest in the factory automation market, Gould has recently announced its purchase of Graphtec, a CAD/CAM software house.

Altos adds terminals and networking

Altos' decision to stop using Televideo terminals and begin making its own is another indication that it is bullish about its future. Claiming to be the leader in the Xenix/Unix market, Altos said it shipped 500 of its 8086-based 586 systems in April; it expects to ship 1,000 a month by year end. With its 68000 business and its Z80 products (which still account for half its sales) Altos expects to be shipping 6,000 terminals a month, enough, it believes, to justify in-house manufacturing. However, the company is quick to point out that its new 14" terminal is not a sign of a general move toward backward integration. Support of the Ethernet chip set was also announced at the show.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR MAY 16, 1983 ● V/19, NO. 2 P.J. MCGOVERN, PUBLISHER

PCM 1982 results, update -- page 5

CONVERGENT TECHNOLOGIES ENTERS SYSTEM BUSINESS: MULTIPLE MICROPROCESSOR ARCHITECTURES TAKE AIM AT MINIS, EVEN MAINFRAMES

"In the 1970s we had the mini challenging the mainframe; in the 1980s we have the micro packaged as a system, equipped to challenge the mini." -- EDP/IR, Nov. 1980

Just as mainframers were caught napping in the 1970s, and sat back watching the rise of the mini, today's mini vendors are feeling the pressure of changing technology and of those firms able to bring it to market quickly. New multiple microprocessor architectures promise improved price/performance and incremental system growth, with the option of low-cost, fault-tolerant capability. Convergent Technologies is just the latest and largest firm to adopt this tack.

Will history repeat itself? EDP/IR thinks that the mini vendors are closer to bridging the technology gap than were their mainframe counterparts a decade ago. Nonetheless, the start-ups have a technological window worth exploiting, and traditional mini and mainframe vendors will be hard pressed to match the technology becoming available from today's merchant semiconductor houses.

Dedicated microprocessors (MPUs) for applications processing, I/O, file management, displays, and networking are the core of the new efforts, as is the use of standardized components such as the Motorola 68000 and Intel 8086 MPU families. By stringing MPUs along a bus, firms such as Convergent, Apollo, Synapse and Auragen are positioned to ride today's technology, building systems ranging from 16-bit minis to the largest of mainframes. Some key issues:

- Architecture. There are two main trends: one is to use MPUs as task-specific devices (CPU, display, data base, I/O, etc.); the other is for several MPUs to share the CPU workload, like tellers in a bank.

- Technology. NCR, HP and Honeywell have developed their own MPUs, further blurring the distinction between micro and mini, and making the captive vs. independent battle more important than ever.

- Software. The start-ups have generally looked to Unix or offshoots thereof. Lack of proven software remains a significant hurdle.

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Convergent enters the system business

Things have gone pretty smoothly for the three-year start up. OEM contracts have come in and 1982 revenues swelled to $92 million. But now the company hopes to move beyond its sophisticated workstations, and into the systems business. The recently announced Megaframe is just the first of a "stream of announcements," the company promises. A portable computer is expected soon.

Convergent says that the Megaframe starts with the power of a supermini and takes off from there, offering a "dramatic price/performance advantage" over traditional superminis. Whereas systems from other multiple MPU vendors aim at specific niches -- i.e., fault tolerance/transaction processing (Stratus, Synapse, Auragen) or engineering (Apollo) -- Convergent sees the Megaframe having general purpose applications, specifically mentioning DDP, transaction processing, scientific/engineering and office automation.

Convergent has also brought some new technological wrinkles to the picture. Unlike the other newcomers, Convergent is mixing different operating systems and microprocessors, while claiming total instruction set and file compatibility. The system can serve from eight to 128 users. Some key points:

- Although the Motorola 68010 is the applications processor, terminal and disk control is performed by Intel 186s. Use of the 186 allows for full compatibility with Convergent's intelligent workstations.

- Bell Lab's Unix and Convergent's Ctos run concurrently and are "virtually transparent to the application and the user." CTOS is said to take care of the weak links of Unix -- realtime operation and file management. Additionally, Convergent says that other operating systems, such as CP/M and MS/DOS, can be easily added in the future.

- Workstation flexibility. Megaframe users can mix and match between Convergent's existing high-end workstations, its new 64K processing terminals, or any ascii terminal, a nice option.

Fault tolerance will come later, but Convergent says that redundancy is not the system's primary selling point. Price/performance, incremental growth, design flexibility and IWS file compatibility are the key benefits. Local area networking features are also expected to be added.

Marketing strategy

Convergent says it intends to stick with its OEM-only marketing strategy. The company reports that it already has a dozen orders in hand, and claims that several dozen more are expected in the next few months. The only contract that thus far has been made public is one with Gould/SEL.

The big question is whether key OEM customers such as Burroughs, NCR and Prime will opt for the megaframe. Despite the fact that Convergent sees the megaframe as "the next level of logical integration," EDP/IR thinks that there is a big difference between OEMing workstations to a company that doesn't have them and selling systems to a company that builds systems. NCR, with its new 9300 and Tower 1632, already has a crowded low-end plate. Burroughs seems more receptive, but the fact that it recently sold off most of its Convergent stock suggests that its business cannot be taken for granted.

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FEATURE COMPARISON, SELECTED MPU-BASED SYSTEMS

	Convergent	Apollo	Aurogen	Synapse	Stratus
Family	Megaframe	Domain	4000	N+1	/32
Microprocessor	68000, 186	68000	68000	68000	68000
Multiple MPUs?	Yes	Yes	Yes	Yes	Yes
Operating System	Unix, CTOS	Aegis, Unix	Auros	Synthesis	VOS
Power Range (Mips)	0.5 - 4	.7/node	1.7-30	1-15	0.9/module
Fault Tolerant?	Not Yet	No	Yes	Yes	Yes
Local Networking?	Not Yet	Yes	Yes	No	Yes
Workstations?	Yes	Yes	No	No	No
Primary Market	Gen. Purpose	Engineering	TP	TP	TP
Primary Sales Strategy	OEM	Direct	Direct	OEM	Direct/OEM
Available	8/83	3/81	4Q/82	4Q/82	1Q/82
Internal Bus Speed MByte/Sec	11	1.5*	20	64	16
Bit-Mapped Graphics?	Yes	Yes	No	No	No
Relational Data Base?	No	No	Yes	Yes	No
Typical System Price ($000)	47	57	138	340	172
Price Includes	4MB Memory, 6 Processors, 200MB Disk, Tape, Terminal	DN 600 1MB Memory 34MB Wini 1.2MB Diskette Software, Network Interface	1.7 Mips, Redundant CPUs, 152MB Disk, Tape Drive,	7 Processors (1GP, 3 I/O, 2 Commo) 6MB Memory, 2 Disks, 2 Controllers Tape Drive, OS	4MB Mem. two 143MB Disks, Printer, Tape, Operating System Console

*Speed between nodes.

Architectures, internal and external

Dedicated microprocessors are becoming increasingly important at all levels of system design. Just as mainframers continue to off-load functions to communications processors, disk and terminal controllers, and even data base machines, small and mid-range system builders are using MPU-based subsystems to improve system efficiency. Whether these subsystems reside in different boxes or in a single workstation, the architectural concepts are similar.

Apollo pioneered the concept of putting multiple microprocessors inside a single workstation. Convergent, Auragen, and Synapse are bringing the same idea to multi-user systems. There is really not all that much difference between the two. For Apollo, with its demanding engineering applications, distributed intelligence makes sense; for others with a commercial orientation, a clustered, timesharing approach is more efficient.

Although microprocessors such as the Z-80 have been used in I/O tasks for some time, only recently have general-purpose, VLSI, 16-bit MPUs been assigned to handle diverse peripheral functions.

Cost is a key factor. Because they can integrate features such as clocks, interrupts, and timers, parts such as the Intel 186 don't require as many

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support chips as the 8-bit MPUs. Thus, on a cost basis the difference in using a 16-bit vs. 8-bit peripheral MPU is becoming insignificant; in some cases the high performance device might actually be cheaper. This suggests that in the relatively near future, powerful 16-bit support chips will be standard, or at least available, even in relatively inexpensive systems.

(An interesting side effect of the movement toward a few highly-integrated MPUs is that hardware is becoming less of an obstacle to software transportability. Just about all the developers of these new MPU systems say that they are free to switch microprocessors to accommodate future hardware advances. Different operating systems are the real portability hangup.)

In addition to using standard MPUs for dedicated tasks, efforts are being made to design specialized MPUs for specialized tasks. The system builder can then pick and choose among efficient components depending on the application. Specialized processors either will be or are available in the following areas:

- Codecs
- Device controllers
- Smart memory
- Floating point arithmetic
- Graphics
- Languages
- Data bases
- Voice recognition
- Network interfaces
- Text
- Hybrid A/D parts

These new chips will not only be the guts of superfast workstations, they will drive down the build costs for new systems and further reduce the barriers to entry in the marketplace. They will also move companies like Intel and Motorola much more into the system business than ever before. Intel has introduced the following specialized chips for its 8086/186/286 family: floating point arithmetic (8087), graphics (82720, second-sourced from NEC), I/O (8089), text (82730), and local area networks (82586 or 82501).

As companies struggle to incorporate these new capabilities, the market may observe a few ironic twists. Consider that the mainframe companies that missed most of the mini action may now be better positioned to align themselves with today's MPU technology than some of the mini vendors who have an entrenched investment in low end systems and software.

Both the mainframe and mini vendors must decide what to develop in-house and what to look outside for. Thus far at least, the major minicomputer vendors have not made much use of independent microprocessor systems. They have focused on cutting costs by reducing their own architectures to the chip level, with an eye toward keeping a lock on their existing software base.

On the other hand, IBM, Burroughs (Convergent), NCR (Convergent), and CDC (Altos) have already aligned themselves with Intel-based systems. Although they have limited themselves to low-end applications, the 8086 architecture has its foot in the door. Whether these firms decide to expand upon it may well be as much a matter of politics as technology and economics.

In short, although it is by no means certain that companies like Synapse and Auragen will succeed, they pose a threat to the status quo that conjours up the lessons of the 1970s. When LSI technology was injected into that market, new vendors arose and some mainframe companies dropped out. Today's microprocessor technology offers similar opportunities and pitfalls. The vendor decisions made in the next few years will be crucial, as the battle between ever-improving hardware and entrenched software and architecture gets played out again.

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PCMs WEATHER STORMY 1982
HIGH-END SUPPLIERS LOOK FORWARD TO BETTER 1983

Fortune did not smile on the PCMs in 1982. Poor financial performance, the collapse of Magnuson, the Japanscam scandal, and Amdahl's 5860 delays were coupled with IBM's bruising 4300 price cuts and beta testing of MVS/XA. On the peripheral front, Storage Technology cancelled both its Virtual Storage System and 8370 drive efforts, while STC, Memorex, and CDC have yielded IBM a two-year head start in the 3380 market.

Given all this, perhaps it is not surprising that 1983 should be a better year. Both Amdahl and NAS expect to do well at the high end, and between the two of them, well over 300 308X class machines could be shipped worldwide this year. In contrast, EDP/IR expects IBM to ship over 2,000 308X CPUs in 1983. Volume PCM 3380s, including a new entrant from NAS, are expected by fall.

On the other hand, IBM's aggressive 4300 pricing and expected new products should keep the low end of the mainframe market under tight control. Both NAS and IPL have tried to target the gap between the 4300s and 308X, but the positioning of these systems will not be fully known until IBM's Glendale series is announced. IPL has announced three-month delays for its gap-filling 4460s and 4480s, now scheduled for second and fourth quarters respectively; NAS' 6600s will start shipping in the third quarter. Some other PCM points of note:

- The dollar value of worldwide 1982 PCM CPU shipments was $575 million up slightly over 1981. Revenues to PCM CPU suppliers were up 9.4%, but the entire PCM CPU business probably operated at a loss in 1982 (NAS does not provide earnings figures).

- NAS has filled out its 308X-compatible line. Its three new 8000 series CPUs will support MVS/XA and are said to offer 10%-30% more performance than comparable IBM 3083s. Shipments begin in June for the 8050 (3083B) and 8060 (3083J); 1984 (1/Q) for the 8040 (3083E).

- Japanese influence is on the rise. NAS no longer manufactures CPUs; IPL is becoming increasingly close to Mitsubishi; and Amdahl's 1982 procurement of Fujitsu "computer subassemblies" was up 81% to a whopping $99.4 million. NAS and Amdahl are selling Japanese peripherals.

- NAS still says it expects to ship its version of MVS/XA by March 1984. Amdahl says it will announce its /XA schedule within the next few weeks. Both have received the necessary source code from IBM.

- Amdahl and NAS have at least two more years to divide the high end between themselves. If Trilogy and STC enter the business in the 1985-86 timeframe, competition will be fierce, and possibly self-defeating, unless IBM begins to lose more than 20% of the pie.

- Europe still looms as a major PCM battleground. The Siemens/Fujitsu team is doing well in Germany. ICL has had less success with its Fujitsu CPUs, but it may market Fujitsu's supercomputers as well.

- The good times won't return to STC and Memorex until they get a profitable piece of the 3380 market. IBM is trying to convert its 3380 lease base to purchase before the PCMs are ready to compete.

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FINANCIAL PERFORMANCE, PCM CPU SUPPLIERS, 1980-1982 ($M)

	1982 Rev.	1981 Rev.	%	1980 Rev.	%	1982 Earn.	1981 Earn.	%	1980 Earn.	%
Amdahl	462	442	4.5	394	12.2	6.8	26.8	-74.6	15.2	76.3
NAS*	230	176	-	-	-	-	-	-	-	-
IPL	15.1	17.0	-11.1	12.6	34.9	0.3	2.1	-85.7	2.7	-22.2
Magnuson	18.4	27.7	-33.6	27.7	0	-21.6	-36.6	-	2.5	-
Cambex	8.0	8.0	0	4.0	100.0	0.1	0.4	-75.0	0.2	120
Total	733.5	670.7	9.4							

*NAS revenue figures are EDP/IR estimates. National Semiconductor does not break out the revenues or earnings of its major divisions.

IBM, HITACHI AND FUJITSU CPUs SOLD IN JAPAN (as of March 1983)

Maker	Computer Model	#CPU	Main Memory	Cache Memory	Max # of Channels	Monthly Rental Charge (K Yen)	*Estimated MIPS Rate	Date Announced	Date of First Installation
IBM	3084-Q	4	32-64MB	64KBx4	48	69,980(32M,48C)	24.8	9/82	9/83
	3081-K	2	16-32MB	64KBx2	24	35,770(16M,16C)	13.8	12/81	9/82
	3081-G	2	16-32MB	32KBx2	24	30,240(16M,16C)	10.2	9/82	11/82
	3081-D	2	16-32MB	32KBx2	24	30,240(16M,16C)	10.2	11/80	9/81
	3083-J	1	8-32MB	64KB	24	22,710(16M,16C)	7.5	4/82	1/83
	3083-B	1	8-32MB	32KB	24	17,840(16M,8C)	5.6	4/82	6/83
	3083-E	1	8-16MB	16KB	16	12,770(16MB,8C)	3.7	4/82	9/83
	4341-12	1	2-16MB	16KB	6	3,340(4M)	1.3	12/82	4/83
	4341-2	1	2-16MB	16KB	6	2,620(4M)	1.1	9/80	9/81
	4341-11	1	2-8MB	8KB	6	2,290(4M)	0.88	3/82	6/82
	4341-1	1	2,4MB	8KB	3	1,800(4M)	0.72	3/79	2/80
	4341-10	1	2,4MB	4KB	3	1,790(4M)	0.64	3/82	6/82
	4341-9	1	1-4MB	2KB	3	1,480(4M)	0.51	12/82	7/83
	4331-2	1	1-4MB	8KB	(4)	1,080(2M)	0.38	5/80	12/80
	4331-11	1	1-4MB	4KB	2	940(2M)	0.26	3/82	6/82
	4331-1	1	0.5,1MB	-	(2)	480(1M)	0.19	3/79	6/79
Fujitsu	M-382	2	32-128MB	64KBx2	64	75,000(32M,32C)	25.0	5/81	8/82
	M-380	1	16-64MB	64KB	64	37,380(16M,16C)	14.7	5/81	4/82
	M-380S	1	16-64MB	32KB	64	26,180(16M,16C)	10.5	6/82	2/83
	M-380R	1	16-64MB	16KB	64	20,880(16M,8C)	7.5	6/82	6/83
	M-360AP	2	8-32MB	32KBx2	16	11,600(16M,8C)	4.9	6/82	2/83
	M-360	1	4-24MB	32KB	12	7,600(16M,8C)	2.9	6/82	2/83
	M-360R	1	4-24MB	32KB	12	3,000(8M,5C)	2.0	2/83	9/83
	M-340	1	4-16MB	32KB	8	2,300(4M)	1.4	2/83	9/83
	M-340S	1	4-16MB	16KB	8	1,580(4M)	0.84	2/83	9/83
	M-340R	1	4-12MB	-	6	1,160(4M)	0.55	2/83	9/83
	M-320	1	2-6MB	-	6	570(2M)	0.35	6/82	3/83
	M-310	1	2-4MB	-	6	430(2M)	0.25	6/82	12/82
	M-170F	1	4-12MB	8KB	12	3,430(8M)	1.66	10/80	3/81
	M-160F	1	1-6MB	-	8	2,610(4M)	0.72	4/79	12/79
	M-150F	1	1-4MB	-	8	1,580(2M)	0.43	4/79	12/79
	M-140F	1	0.5-6MB	-	6	1,000(2M)	0.33	4/79	7/79
	M-130F	1	0.5-4MB	-	4	460(1M)	0.18	4/79	6/79
Hitachi	M-280H MP	2	16-64MB	256KBx2	64	62,100(32M,32C)	24.7	2/83	9/83
	M-280H	1	16-64MB	256KB	32	31,000(16M,16C)	14.2	2/83	9/83
	M-280D	1	16-64MB	64KB	32	23,000(16M,16C)	10.5	2/83	9/83
	M-260K	1	8-32MB	64KB	24	16,500(12M,12C)	7.5	2/83	9/83
	M-260H	1	8-32MB	64KB	24	11,000(8M,8C)	5.7	2/83	9/83
	M-260D	1	8-32MB	32KB	24	8,000(8M,8C)	4.1	2/83	9/83
	M-240H	1	2-16MB	64KB	8	4.520(8M)	0.6	2/81	3/82
	M-240D	1	2-8MB	64KB	5	3,000(8M)	1.5	6/82	12/82
	M-220K	1	2-8MB	-	3	2,250*(4M,3C)	-	3/83	3/84
	M-220H	1	1-8MB	-	5	1,200(4M)	0.6	6/83	3/83
	M-220D	1	1-8MB	-	3	1,000*(2M,3C)	-	3/83	9/83
	L-470	1	1-4MB	-	-	400(1M)	-	1/83	10/83
	L-450	1	0.5-2MB	-	-	230(0.5M)	-	1/83	10/83

*Estimated by EDP/Japan Report

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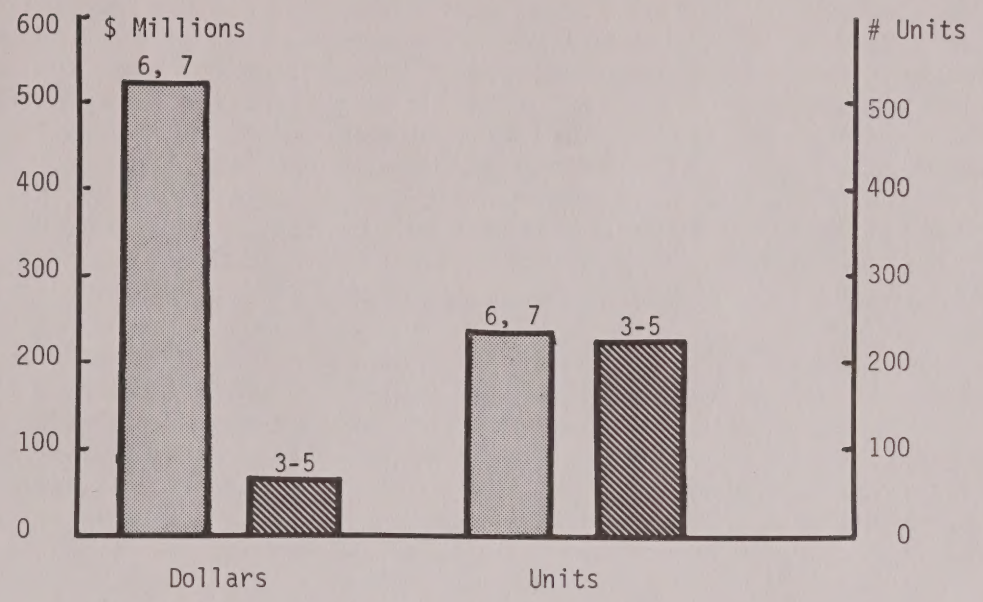
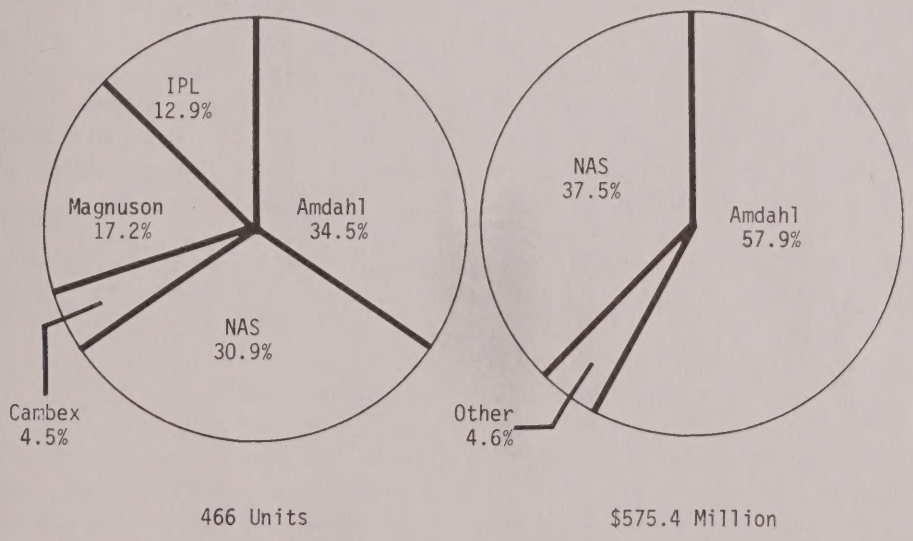
WORLDWIDE PCM SHIPMENTS BY SIZE CLASS -- 1982
(Copyright 1983 -- International Data Corp.)

Typical Model	Size Class
4331-1	3
M80/20	3
4341-1	4
IPL 4443	4
4341-2	5
AS/5000	5
3083J	6
470 V7C	6
3081K	7
AS/9060	7
5860	7



1982 WORLDWIDE PCM CPU SHIPMENT MARKET SHARES, UNITS vs. VALUE
(Copyright 1983 -- International Data Corporation)



NAS' new 3083 and 3380 competitors

National Advanced Systems continues to fulfill its pledge to be a broad line PCM supplier. Its 6600, 8000, and 9000 series offer a continuum of power throughout the size class five, six and seven range. In August, it will start shipping its 3380-type drive (called the 7380) in addition to its 3350 type, 7360. NAS believes that there will continue to be a healthy demand for 3350 drives until MVS/XA and its dynamic channels are in wide use. Over the next few years the company plans to grow at 30% per year. Although it still doesn't have the market presence of Amdahl, the company has made significant strides in the last two years, and looks well positioned for at least the next 18 months. The shutting down of its CPU manufacturing business should boost profitability.

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• COMMENTS AT INTEL's SHAREHOLDER MEETING. Intel reports that demand is definitely strengthening as the economy recovers, and that most of Intel's advanced products -- especially the 186/286, board-level systems, and high-density Eproms -- are doing well. President Andrew Grove noted that while sales of the 432 have been dissappointing, interest within the university community is high, with "hundreds of researchers" working with it. Grove does not expect automation to bring assembly-type jobs back to the U.S., noting "the principal reasons to automate are better process control and uniformity rather than labor saving ... I would never anticipate shutting down our overseas plants in order to bring assembly back."

• NBI SHOWS FLASHY HARDWARE. Shedding its "strictly WP" image, NBI introduced its System One, a 68010 and Unix-based multiprocessing, virtual memory, Integrated Workstation (IWS) with a Lisa-like user interface. Using dedicated microprocessors for the keyboard, screen, disk, and communications, NBI claims four times the power of Lisa, with twice the screen resolution. Its new intelligent workstations and accommodations to the IBM PC give further evidence that NBI is intent on becoming a full-blown OA workstation supplier. Shipments of the System One begin second quarter 1984. $12,500 will buy 1MB memory, a 12MB hard disk, lots of software, communications links and a 14" diagonal screen.

• CDC'S NORRIS TAKES SHOTS AT JAPAN. Saying that he is tired of Japanese procrastinations, CDC Chairman William Norris has proposed that Japanese nationals be denied admission to U.S. graduate engineering programs until U.S./Japan trade restrictions are removed. In particular, Norris accused the Japanese of stalling CDC's Cybernet operations for a full 10 years. Although the plan is unlikely to attract significant support, Norris' boiling-over is indicative of the rising level of hostility that threatens U.S./Japan relations. Expect officials on both sides to downplay the incident.

• LOTS OF PC MAINTENANCE ACTION. Xerox is hiring out its service organization, recently signing contracts with Osborne, Epson, Pied Piper, Morrow, Corona and others. Meanwhile, in 38 cities, IBM is now offering onsite service for its PCs, at about 25% more than the cost of courier pick-up. Non-linear Systems, builders of the Kaypro, have signed on with MAI.

• PRIME TO MARKET FORD DESIGN SYSTEM. Prime will have exclusive rights to the Product Design Graphics System (PDGS), a three-dimensional design and drafting system that has been used internally at Ford for the past ten years. Now running on over 100 Prime systems, PDGS works on all of Prime's 50 series machines, with the initial software copy priced at $95,000. Ford's suppliers are expected to be a major market.

• SEAGATE TO SUPPLY PHILIPS: SUSPENDS REMOVABLE DRIVE PROJECT. The four year "multi-million dollar" deal covers Seagate's 6MB, 12MB, and 19MB drives to be used in Philips' CP/M-based P3500 system, recently shown at the Hanover Fair. Citing a shortfall in plated media, Seagate has suspended all marketing of its 5.25" removable cartridge drive. Seagate believes that the durable plated media is necessary to withstand a removable drive's constant head loadings.

• DEC CRACKS FORTUNE 100. Rising 42 places over 1981, Digital Equipment now ranks 95th on the prestigious list, 32nd in terms of net income.

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EDP industry report

● THE INTERNATIONAL DATA CORPORATION'S NEWSLETTER FOR EXECUTIVES CONCERNED WITH THE ELECTRONIC DATA PROCESSING INDUSTRY

"The Gray Sheet"

DAVID MOSCHELLA, EDITOR APRIL 30, 1983 ● V/19, NO/1 P.J. MCGOVERN, PUBLISHER

Micro-to-mainframe action -- page 5

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IBM SHOPS LEAD WAY TO 13.8% MIS GROWTH DESPITE RECESSION; USERS EXPECT SPENDING TO INCREASE 14.5% in 1983

Thanks to strong demand from the IBM customer base, the great recession of 1982 did not put an end to the steady expansion of MIS department spending. International Data Corporation's annual user spending survey and analysis shows that MIS spending grew 13.8% in 1982, thanks primarily to sustained application demand and strong shipments of IBM's 3081 processors and 3380 disk drives.

When the IBM base is taken out of the picture, the recession begins to show its teeth. U.S. revenues for the non-IBM mainframers grew at less than 4% in 1982, compared to IBM's 25%. And although revenues do not always directly reflect user spending, the dichotomy of performance between IBM and its traditional competitors was perhaps the key mainframe development of 1982.

Because 1982 was IBM's year, the habits of its customer base to a large extent determined the shifts in this year's MIS spending data. Perhaps the most significant changes were dramatic jumps in outright purchases and in third party leasing, developments which were clearly forced upon users by IBM's steadily declining purchase/lease ratios. Increases in spending for hardware manufacturers' software reflect changes in IBM's pricing policies as well as a sharp increase in the number of large IBM CPUs installed.

On the negative side, user cutbacks tended to focus on personnel and overhead. Because of the drop in inflation, hiring and salary freezes, slower turnover rates, and some slack in the demand for MIS staff, salary spending increased by just 9.5%, while expenditures for travel and training increased by just 4.5% and 2.9%, respectively. Other notable points include:

- The overall spending increases mask some real differences in specific industry growth rates.
- IBM's lease and rental revenues may decrease in 1983, having fallen 9% in first quarter 1983. Purchase conversion rates remain high.
- From a vendor revenue perspective, the U.S. mainframe and mini markets grew 18.2% vs. 9.7% internationally.

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REVENUES AND EARNINGS, SELECTED MAJOR VENDORS, 1981-82 ($M)
(Copyright 1983 -- International Data Corp.)

	Rev. 1982	Rev. 1981	Δ%	Earn 1982	Earn 1981	Δ%	Yr. Ending
IBM	34,364	29,070	18.2	4,409	3,610	22.1	12/82
Amdahl	462	442	4.5	7	27	-74.1	12/82
Burroughs*	4,186	4,100	1.0	117	141	-17.0	12/82
CDC	3,301	3,120	5.8	141	196	-28.1	12/82
NCR	3,526	3,432	2.7	234	208	12.5	12/82
Honeywell	1,685	1,774	-5.0	80	158	-49.3	12/82
Sperry	2,818	2,791	1.0	-	-	-	12/82
STC	1,079	921	17.2	64	82	-22.0	12/82
Subtotal	51,421	45,650	12.6	5,052	4,422	14.2	
DEC	3,880	3,198	21.3	417	343	21.6	07/82
Datapoint	508	449	13.1	2.4	49	-95.1	07/82
DG	805	736	9.4	25	51	-50.1	09/82
Prime	435	364	19.5	44	37	18.9	12/82
HP	2,212	1,816	21.8	370	314	17.8	10/82
Tandem	335	208	61.0	37	26	42.3	9/82
Subtotal	8,175	6,771	20.7	895.4	820	9.1	
ADP	669	558	19.9	58	49	18.4	06/82
Tymshare	297	289	2.8	9	16	-43.7	11/82
EDS	509	454	12.1	47	38	23.7	06/82
Comp Sci	503	449	12.0	13	11	18.2	03/82
Subtotal	1,978	1,750	13.0	127	114	11.4	
MSA	101	73	38.3	9.0	5.5	63.6	12/82
Cullinane	56	33	70.0	8.4	5.4	55.5	07/82
Pansophic	37	32	15.6	4.9	2.9	69.0	07/82
Subtotal	194	138	40.5	22.3	13.8	61.6	
Wang	1,159	856	34.5	107	78	37.1	06/82
CPT	145	101	43.5	15	12	25.0	06/82
NBI	100	57	75.4	11	7	57.1	06/82
Xerox	1,800	1,700	5.8	6	85	-92.9	12/82
Subtotal	3,204	2,714	16.7	139	182	-24.9	
TOTAL	64,972	57,023	13.9%	6,235.7	5,551.8	12.3	

Notes: Revenue figures are for computer businesses only. Hewlett-Packard data includes calculator revenues, and Xerox data includes office equipment as well as facsimile, electronic typewriters, toner and some other supplies. Sperry does not break out the earnings contributions of its major divisions. * Burroughs 1981 revenue figure shows what revenues would have been had Memorex been consolidated January 1, 1981.

As the chart shows, for the sample above the aggregates for 1982 -- revenues up 13.9%, earnings up 12.3% -- were not all that bad given the recession and a 1982 inflation rate of about 5%. If, however, IBM is taken out of the picture, revenues were up just 9.5% and earnings actually fell by 5.9%.

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TOTAL U.S. USER SPENDING FOR 1983
($ Millions)

	Spending 1981	% Budget 1981	% Growth 81/82	Spending 1982	% Budget 1982	% Growth 82/83	Spending 1983	% Budget 1983
Rental and/or Lease Payments to Manufacturers	8,375	12.70	5.5	8,835	11.8	2.0	9,015	10.5
Payments to Third Party Lessors	2,330	3.50	35.0	3,145	4.2	28.8	4,050	4.7
Depreciation for Purchased Equipment	3,140	4.80	32.5	4,160	5.5	30.0	5,410	6.3
Maintenance Charges	2,360	3.60	20.0	2,835	3.8	18.0	3,345	3.9
Other	550	0.80	20.0	660	0.9	15.2	760	0.9
SUBTOTAL	16,755	25.40	17.2	19,635	26.2	15.0	22,580	26.3
Data Entry Equipment	745	1.10	2.7	765	1.0	0.0	765	0.9
Terminals and Terminal Controllers	2,780	4.20	25.0	3,475	4.6	20.3	4,180	4.9
Other	340	0.50	17.6	400	0.5	15.0	460	0.5
SUBTOTAL	3,865	5.90	20.0	4,640	6.2	16.5	5,405	6.3
SW Use Charges by Computer Manufacturers	1,350	2.00	29.5	1,748	2.3	32.9	2,323	2.7
SW Use Charges/Independents	850	1.30	39.7	1,187	1.6	41.5	1,680	2.0
Custom Prog./Consulting	1,130	1.70	17.4	1,326	1.8	20.6	1,599	1.9
Timesharing/SB Expenditures	960	1.50	8.3	1,090	1.4	8.8	1,131	1.3
Other	255	0.40	5.0	269	0.4	6.7	287	0.3
SUBTOTAL	4,545	6.90	22.6	5,570	7.4	26.0	7,020	8.2
Tape Reels, Disk Packs Floppy Disks	425	0.60	20.0	510	0.6	12.7	575	0.7
Computer Forms	1,905	2.90	5.0	2,000	2.7	8.0	2,160	2.5
Cards, Ribbons, etc.	265	0.40	7.5	285	0.4	8.8	310	0.4
SUBTOTAL	2,595	3.90	7.7	2,795	3.7	9.0	3,045	3.5
Voice Communications (Equip. and lines)	2,550	3.90	11.0	2,830	3.8	14.0	3,225	3.8
Data Communications (Equip. and lines)	2,625	4.00	30.7	3,430	4.6	24.9	4,285	5.0
SUBTOTAL	5,175	7.80	21.0	6,260	8.3	20.0	7,510	8.7
Salaries	26,405	40.00	9.5	28,910	38.5	11.8	32,310	37.6
Travel	670	1.00	4.5	700	0.9	12.0	785	0.9
Training	340	0.50	2.9	350	0.5	10.0	385	0.4
Other	2,015	3.00	19.9	2,415	3.2	15.1	2,780	3.2
SUBTOTAL	29,430	44.60	10.0	32,375	43.1	12.0	36,260	42.2
Rent, Utilities, Overhead	2,340	3.50	6.0	2,480	3.3	10.1	2,730	3.2
Other	1,285	2.00	2.0	1,310	1.7	6.9	1,400	1.6
SUBTOTAL	3,625	5.50	4.5	3,790	5.1	9.0	4,130	4.8
TOTAL	65,990	100.00	13.8	75,065	100.0	14.5	85,950	100.0

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INFORMATION PROCESSING REVENUES, U.S. vs. INTERNATIONAL ($M)
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	1982 U.S.	1981 U.S.	Δ%	1982 Int.	1981 Int.	Δ%
IBM	18,900	15,116	25.0	15,464	13,954	10.8
Amdahl	285	260	9.6	177	182	-2.7
Burroughs	2,427	2,460	-1.3	1,759	1,640	7.3
CDC	2,244	2,121	5.8	1,057	999	5.8
NCR	1,798	1,647	9.2	1,728	1,785	-3.2
Sperry	1,493	1,479	0.9	1,325	1,312	1.0
STC	794	736	7.9	285	185	54.0
Subtotal	27,941	23,819	17.3	21,795	20,057	8.7
Datapoint	330	345	-4.3	178	104	71.1
DEC	2,483	1,950	27.3	1,397	1,248	11.9
DG	571	515	10.9	234	221	5.9
Prime	274	222	23.4	161	142	13.4
HP	1,194	944	26.5	1,018	872	16.7
Tandem	215	141	52.5	120	67	79.1
Subtotal	5,067	4,117	23.1	3,108	2,654	17.1
Total	33,008	27,936	18.2	24,903	22,711	9.6

MIS SPENDING BREAKOUTS 1977-1983,
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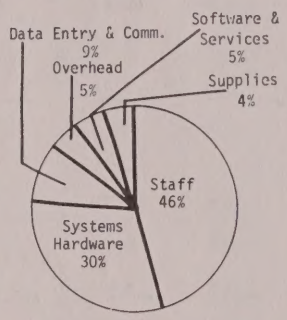
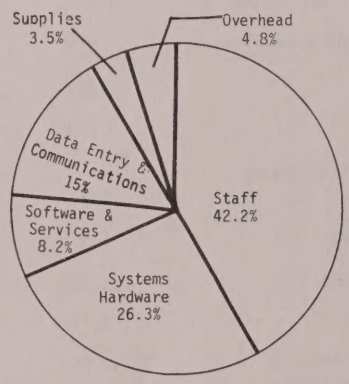


1977 $35.8 Billion



1983 $85.9 Billion

Users do not expect dramatic changes in 1983. Software, maintenance, communications and terminals will continue to be the fastest growing budget items, and if the recession eases, salary caps will have to be lifted. Despite increasing emphasis on end user demand and chargeback systems, overall MIS spending will expand steadily for the foreseeable future, especially in information-intensive industries such as banking, insurance, health and services.

From the vendor side, IBM's dominance is likely to continue in 1983. Although Burroughs, Honeywell, and CDC will be shipping new generation high-end mainframes, the Bunch is not expected to have a good year in 1983. IBM, on the other hand, continues to boast that it plans to ship record numbers of high-end processors and 3380 drives, and its PCs are now being bought by MIS departments in significant numbers (see following story).

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MICRO-TO-MAINFRAME LINKS ATTRACT ATTENTION AS NEW FORM OF DDP EMERGES

Long more of a concept than a reality, Distributed Data Processing (DDP) is at last becoming a very hot market. Thanks to the proliferation of micros, and in particular the IBM PC, users and vendors are taking a second look at how computing tasks should be done.

Micros have changed the DDP concept altogether. Mini-based DDP was primarily a top-down strategy that farmed out mainframe applications to local sites. In contrast, micro-based DDP has become a bottom-up industry. Most micros are initially installed as standalone systems intended to automate previously paper-based tasks. Only now are users starting to sense the value of tying their micro work into existing data processing resources.

This need, or at least perceived need, is attracting widespread interest from many industry segments -- micro and mainframe software suppliers, service bureaus, hardware vendors, start-ups and perhaps most importantly MIS departments. Corporate PCs are being installed at such a phenomenal rate that all of these groups know that how well they adapt to the micro might very well determine their future place in the industry. Some of the key forces:

- IBM's blessing. The IBM PC has virtually created this DDP interest, and is the focus of 90% of the activity. The ability to upgrade a 3278 to a PC and the availability of 3270 PC bisynch have shown users that IBM is serious about integrating PCs into its large data nets. IBM is now referring to the PC as an "important strategic product."

- Software and services companies. The success of the IBM PC has bred a whole new sub-industry as McCormack and Dodge, MSA, Informatics, Cullinet, Data Resources Inc., Geisco, Computer Sciences, Comshare and others scramble to prepare IBM PC/IBM mainframe links, often in conjunction with a PC software supplier -- Visicorp, Lotus, etc.

- MIS issues. MIS departments are having a difficult time controlling micro use without stifling user initiative. Stores, internal standards, and information centers have begun, but the sheer number of PCs being installed makes careful monitoring virtually impossible.

- Vendor dilemma. How does the success of micros jive with the emphasis being put on mini-based departmental systems by companies such as DEC, DG, Prime, Sperry, Wang and, to some extent, IBM? Unless the PC is integrated as a workstation, conflicts will arise.

- Compatibility. Only Honeywell has pushed for total instruction set compatibility for its micros, minis, and mainframes. Unless other vendors copy this tactic soon, any micro/mainframe compatibility work will have to be done through communications and emulation. EDP/IR expects the Honeywell approach will be followed by others.

What is clearly emerging is a massive need for systems integrators. Service bureaus, hardware vendors, information centers, and forward-looking MIS groups can all provide the handholding that users need to confidently build mainframe/micro links, and issues of access, security, integrity, and cost-effectiveness can only be evaluated by those familiar with MIS data center requirements.

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Value-added suppliers step in

In the 1970s, service bureau efforts to install on-site minis for DDP-type tasks attracted a lot of attention but failed to become an important market. ADP, Computer Sciences, Tymshare, National CSS, CompuServe, and Rapidata were among those who launched significant on-site programs, most of which have either ended or become stable, and, in the case of ADP, sizable, niches.

Yet it does not follow that the overall disappointment of those efforts will be repeated. For one, the use of on-site micros will serve a bigger market and perform different tasks than do on-site minis. On-site minis were based primarily on the old DDP theory, off-loading mainframe tasks such as transaction processing, data collection, or report generation.

Micros on the other hand will primarily focus on downloading data for interactive problem solving and ad hoc analysis functions, while serving a more professional, less data processing-oriented customer. Unlike the old DDP which basically reallocated a fixed quantity of applications, micro/mainframe links will expand the total amount of processing performed, while possibly offering some relief to today's application backlog headaches.

Micros will, however, also compete with and expand the market for the distributed mini. Once the major vendors move their architectures down to the micro level, low-cost, instruction-set compatible DDP will be possible. A large MIS department will be able to replicate common applications at multiple sites that could not have afforded a full-blown mini configuration. Chain stores, branch banks, and small government offices are three good examples.

The recent announcements by Cullinet, Informatics, and McCormack and Dodge all focus on the new type of DDP, integrating spreadsheet, data base, graphics and ad hoc query capabilities with IBM mainframe data. The approach is to install a pair of programs, one at the IBM host and one in the PC (usually IBM also) to form an intelligent downward link that is, presumably, relatively easy to learn. Of the recent announcements, only McCormack and Dodge claims to offer a similar uplink capability. The major alliances are listed below:

- Data Resources/Visicorp/IBM PC
- McCormack and Dodge/Lotus/IBM PC
- Cullinet/Apple Lisa/IBM PC
- Informatics/Visicorp/IBM PC
- Interactive Data/Microsoft/IBM PC
- MSA/Peachtree/IBM PC

EDP/IR does not see these products adversely affecting mainframe sales. Mainframes will continue to be the best means of keeping a large body of data consistent and current, and will still be the most effective way to deal with large, repetitive production tasks. The mainframe/micro link comes down to two things: that micros are better suited to custom applications and rapid response, and that mainframes should have better things to do than hold hands with a dumb terminal. If the price is right, downloading makes sense.

But right now the price looks a little prohibitive, users will be looking at mainframe software prices, none of this $200 per package stuff. McCormack and Dodge is charging $25,000 per mainframe CPU plus $2,500 per IBM PC so that a fifty PC set up will cost $150,000 just in software. Informatics is charging about $50,000 for a fifty PC version of its link between Visicalc and its Answer/DB query facility. MSA charges $3,000 per PC link with a minimum of 15 users. Unlike PC hardware, such outlays will usually require MIS approval.

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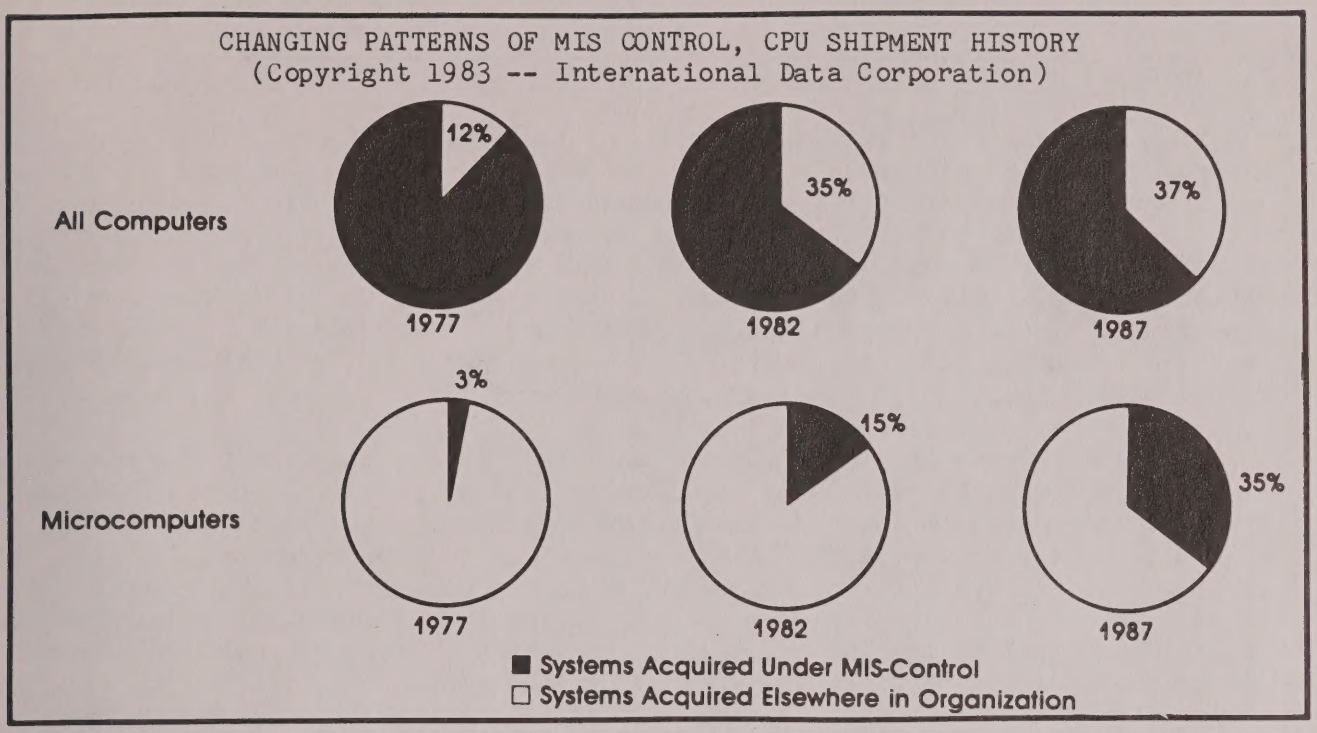

The high prices suggest that departmental systems with mini/mainframe links may be very competitive in certain environments. After all, 15 IBM PCs and $50,000 of software can easily become a $125,000 system, and at those prices other computing alternatives must be looked at carefully. Many department-level systems can or will soon be able to simulate personal computing functions (if not response times), while enjoying the economies of shared storage and printing facilities, as well as centralized budgetary control. The major hardware vendors aren't yet pushing PC-based local network solutions.

IBM is trying to integrate the PC with all of its various departmental systems -- the 8100, 4300, 5520, S/1, and S/38. If it can pull it off, such integration would be difficult for its PC competitors to match. For those users who want integrated systems, the combination of third party applications and micro/mainframe software, along with IBM's own interconnection efforts looks almost unbeatable as long as IBM's PCs continue to keep pace with competition.

The processing services firms also hope to capitalize on this micro/mainframe market. Over the last few years, their business has steadily shifted towards end users, and they are used to the requisite handholding. Additionally, firms such as Geisco, CDC, and Tymshare have already built sophisticated interprocessor communication nets. To keep their customers from drifting away to other processing alternatives, the services firms are sure to come out with some attractive micro/mainframe packages, most likely closely coupled to outside data services. These companies did not have a good year in 1982 and they see the micro as a way to provide new value-added products.

The software, hardware, and services interest is just the latest tribute to the importance of the micro in MIS environments. Personal computer sales to the business/professional market are growing at over 40% per year, and the combined power of these systems is becoming astronomical. An unexpected, but crucial side effect has been a further enhancement of IBM's market position: it controls the host and is rapidly gaining control over the micro, and if it ever comes out with a good system in the middle, the grip could be unshakeable.

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• OPEL SPEAKS TO IBM STOCKHOLDERS. Among the tidbits offered by the new chairman at Big Blue's annual meeting: the PC has become a very important strategic product, and the intelligent workstation is the "lynchpin to the future from entertainment to professional use; company margins are steadily improving; two-thirds of IBM's assets have been added in the last five years; net installations are up significantly; IBM will increase its use of retail channels and thus far it has been very satisfied with the service and support; IBM expects that growth in its U.S. and international markets will be about the same -- the recent shift toward the U.S. is mostly a currency effect.

Opel also pointed out that: IBM is making a "serious commitment" to robotics and is trying to expand the business as fast as it can. For its Japanese personal computers, it looked toward Matsushita because it could not have otherwise gotten to the Kanji market as quickly; IBM Japan grew 27% last year and now employs 13,000 workers. Most of what the Japanese fifth generation project is planning, IBM has been working at for a long time, and IBM can do on its own. Internally, IBM has one CRT for every three employees. It needs the help of third party software groups and will continue efforts to cooperate. AT&T will compete directly with IBM and it will be good for the customer. IBM is still prohibited from marketing used equipment by the Consent Decree; IBMCC is financing a "great deal of IBM's business" and is a key reason why IBM's purchase revenues are increasing so fast. IBM continues to increase its efforts to protect its assets.

• MAINFRAMERS REPORT FIRST QUARTER RESULTS. IBM continues to be the only real bright spot. The giant's revenues were up 17.3% and earnings were up a whopping 23.6% over first quarter 1983 as purchase revenues continue to pour in. Whether these successes merely reflect a decision to take the money now and worry about revenue streams later remains to be seen.

Honeywell reports that its information system business faces a difficult year. It reports a "modest operating profit" compared to a "small operating loss" last year, and adds that shipments remain low; U.S. orders are up, but international orders are down. NCR fared slightly better with earnings up 10.7% on revenues up 3.7%. NCR reports order improvements. If accounting effects are factored in, CDC's earnings were down 2.3%, with revenues down 1.6%. Slow peripheral sales continue to be the dominant problem; CDC expects things to pick up in the second half of the year. Including accounting effects, Burroughs says that both revenues and earnings were just about flat in the first quarter, but it reports that orders are up. The one non-IBM bright spot was Amdahl with revenues up a solid 56.4%, and earnings doubling.

• SPERRY JOINS MAGNETIC PERIPHERALS, DELAYS 1100/90s. Under the agreement, Sperry will acquire a 13% share, leaving CDC with 67%, Honeywell with 17% and CII with 3%. On the dark side, Univac's 1100/90 large CPUs have been delayed 9 months until March 1984. Volume ships won't begin until August 1984.

• DEC CONTINUES AGGRESSIVE MEMORY PRICING. DEC's $3,400 per MB on its entire VAX line (in 10MB increments) is one of the lowest prices EDP/IR has seen from a major vendor. Even in one, two, and four MB increments, prices are less than $5,000. Maximum memory on the Vax/780 has been increased to 32MB. IBM charges $10,000/MB for all its mid-range systems, $25,000/MB on its 308X line.

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